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## THIS ISSUE

Those interested in Tests, and those who ought to be, should not overlook the masterly article on "Tests and the Classroom Teacher" by Harry B. Nash and Roy R. Van Duzee; nor should they pass up the study on "The Reliability of Shop Teachers' Marks" by Louis V. Newkirk. Both of these articles and a number of typical tests appear in this issue.

The new-type tests are with us to stay. They are not perfect yet, but further study and experimentation will overcome their present shortcomings.

## OUR POSTERS

Because of lack of space, the posters had to be omitted this month. They will be resumed in the next issue.

## THIS MONTH'S COVER

The young electrician whose picture graces our cover this month is a student of the Seneca Vocational School, Buffalo, New York. He is winding the stator of an induction motor designed in the trade drawing class of that school.

Photo submitted by Hiram E. Greiner, Old Central High School, Buffalo, N. Y.


*Articles Indexed*—The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."

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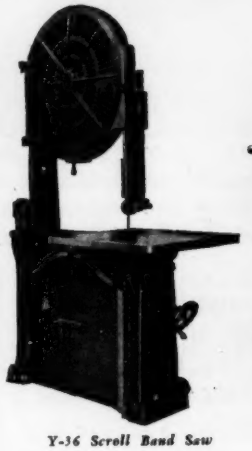
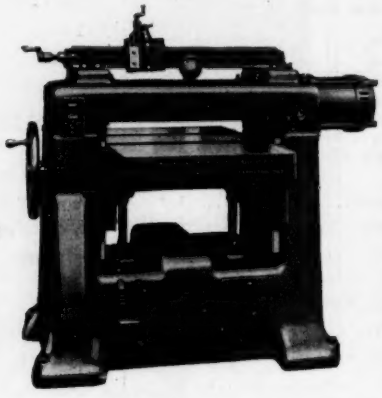
# Do you Consider PRICE before VALUE and SERVICE?

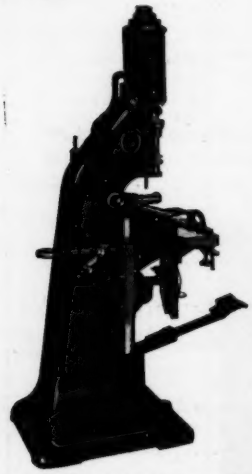


*Y-36 Scroll Band Saw*



*B-4 Single Surfacer, 24 x 8"*

*No. O Saw Bench*



*K-25 Hollow Chisel Mortiser*

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Volume 20 APRIL, 1931 Number 4

# Tests and the Classroom Teacher—I

*Harry B. Nash and Roy R. Van Duzee**

MOST teachers are interested in methods which will help increase the effectiveness of their teaching. From the standpoint of improving instruction, the various types of objective tests are probably one of the most effective devices that can be used. These tests may take the form of either the published tests or the informal objective test, constructed by the teacher, which uses the new-type questions based on the local course of study and the classroom method used by the teacher. These tests fall into the following classification:

I. *Prognostic Tests*

These may be given before the student starts his course to determine special abilities. These tests are published and commonly take the form of tests in which:

1. Parts of a device are to be assembled.
2. Pictures of machine parts are to be associated with certain machines.
3. Names of tools, materials, or parts are to be matched with other tools, materials, or parts of machines.
4. Physical and mental reactions are measured.

The results of these tests are useful in determining the selection of types of shopwork the pupil is best able to pursue.

II. *Inventory Tests*

When the students in a class have had different kinds and amounts of training, it frequently is desirable to give an inventory test. The purpose of this test is to determine what the pupil already knows and can do so that a point of departure, based upon the initial work of the individuals of the class, may be found. The technique used for the construction of inventory tests is the same as that followed for making unit tests.

III. *Unit Instructional Tests*

These definitely aid both the teacher and pupil in that they:

1. Show the pupil's progress in the acquirement of skill and knowledge in order to determine upon a definite, intelligent procedure of teaching.
2. Disclose learning difficulties of students. They show which part of the work has proved most difficult for the student to master and, consequently, which parts of the course need reteaching.
3. Provide a basis for determining whether or not a student should proceed to the next unit of work.
4. Furnish an objective record upon which marks may be wholly or partially based.
5. Give a record of individual and class record.

Unit tests should be used when a definite teaching unit has been completed and may be used to test the knowledge of tools, processes, materials, constructions, design, order in which work is to be done, shop rules, and shop safety. They may also be used to disclose how much information has been gained through trips to factories and shops, and through conferences with workers, or from viewing films, attending lectures and discussions, or from the use of other teaching devices, such as illustrative material, drawings, etc. Properly constructed tests must parallel the objectives of the course and test all significant phases of instruction, i.e., knowledge and attitudes acquired, and skills developed.

IV. *Informal Objective Final Tests*

These cover the content the same as the unit tests, but the sampling is less minute. The items tested, in many cases, may be the same as those used in the unit tests. These items should not be used in the same type of question, but should be restated, using some other form of question. Where but one class is to be measured by a test, the test is usually made out by one individual; however, where the same test is to be given to several classes, a group of teachers may prepare the test as a committee project. The procedure to follow in building the test is essentially the same in either case.

V. *The Standard Test*

This test enables the classroom teacher to find out how his classes compare with others doing the same kind of work throughout the United States. Tests of

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this type are constructed by test experts using accepted test-construction techniques, covering significant common content, and they are provided with norms (scores showing average achievement under like age, grade, or time exposure). These tests have been subjected to a rigid statistical procedure to insure that they measure accurately what they propose to measure. They are provided with directions for giving and scoring, a means for recording scores, and a plan for interpreting the results. Briefly stated, the standardized test has the following uses not possessed by locally constructed tests. It provides:

1. A means of comparing the achievement of your school with representative schools throughout the country.
2. A means of determining progress. The use of one form of test at the beginning of a course and an alternate form at the end will show the progress in terms of the author's norms.
3. A means of assigning definite standards of achievement.
4. A basis for classification of students.
5. A means for promoting educational research in the industrial-arts field in determining the answers to such questions as proper size of classes, correlation between intelligence and shopwork, and the relative merits of various methods of instruction.

VI. *The Performance Test*

This test is sometimes called the practical test. It is a very important type and is receiving too little attention in some subjects, such as mechanical drawing. With this test, both information and ability to perform may be tested on paper. However, with most shop subjects the performance cannot be adequately tested in this manner. It is quite reasonable to expect that certain minimum skills in shopwork have been acquired as well as certain minimum amounts of related information obtained after a student has taken a shop course for a certain length of time. Of course, it may be said that we can "observe" the work of the pupil and "judge" the product, but, at best, this method is open to great inaccuracy due to its subjectivity. Performance ability can be as accurately measured in most shopwork as we can now measure information. To illustrate, take the subject of printing. What should be the standard for setting straight matter after a given time spent in a junior-high-school printing course? This question can be answered by finding out the speed with which the students can set type under controlled conditions, such as uniform direction of the student; kind of copy used (content, manuscript typed or printed); kind, size, and condition of type; the width of the line set; and the length of time allowed for the test. If the plan of scoring takes into account the penalty for errors, it merely becomes a matter of measuring the number of ems set to determine the skill that the student has in setting straight composition. With the exception of the *prognostic* and *standard* tests the teacher may construct his own tests. This is particularly true of the unit and final tests. The procedure in building these tests is essentially the same and is as follows:

1. Analyze the content to be covered in terms of the abilities or acquisitions that you are testing for. The course of study that you covered is the basis for this analysis.
2. Make a study of the types of questions suitable for testing the abilities and acquisitions which the student has developed and acquired. This study will show that not all types of questions are suitable when applied to industrial-arts and vocational-education content; some types of questions are suitable to test factual material, some test associations, some test ability to interpret problems or situations, some test problem-solving situations. Certain techniques found useful in testing manual skill with one medium, are not usable under other conditions.

The type of question to be used depends on the abilities that are to be tested. As we become more expert in the construction of tests, they tend to become less factual and challenge the pupil's ability to use facts in problem-solving situations. For example, in differentiating abilities involved in lettering in mechanical drawing, one finds at least three different factors. Thus the information which the student possesses about size, shape, slant, proportion, weights of lines, how strokes are made, and the like represent one of these factors. Then the ability to select good lettering is another, while the ability to letter well is a third. From an achievement standpoint, it is sufficient to see samples of lettering to know how well a student can letter; however, from a teaching standpoint, it is necessary to know what factors contribute to his failure to letter well. Is the difficulty in not knowing the fundamental shapes, proportions; or is it because he does not know how to go about the work; or is the trouble purely manual? The type of question to be used, then, must be suitable to the ability being tested. There are a number of types of questions which might be used, and it should be the purpose of the classroom teacher when making an examination to select the type of question which fits the material to be tested and parallels the teaching objectives. Many teachers are familiar with the various types of objective questions and seem to think that the criteria of a good examination is that a certain number of questions of each type are included. The criteria, however, is not how many types of questions are used, but whether the types selected are suitable to the material to be tested, and whether they parallel the teaching objectives. It may happen that in the construction of a classroom test only one type of question need be used, and yet the examination may satisfactorily parallel the objectives of the unit of work being tested. On the other hand, it may be necessary to include two, three, or even four types to satisfactorily test the unit of work.

Let us say, for example, that our objectives of teaching shopwork in the junior high school are to:

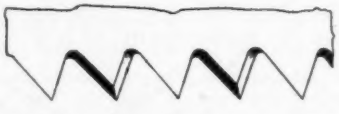
1. Develop handy-man abilities.
2. Develop consumer intelligence.
3. Discover and develop aptitudes, interests, and abilities.
4. Develop industrial insight.

To illustrate the use of the various types of questions applied to the content of junior-high-school shopwork in the light of these objectives, let us consider some specific material. Take the question of woodwork, of ripping and crosscutting, and the saws which are used to perform these operations. We will assume that for the period of work covered, the students have studied the kinds of saws, their names, characteristics, use, and proper care. Consider three types of questions that may be used to test the use of saws and the information learned regarding the operations to be performed—True-False, Completion, and Multiple-Choice.

### True-False

*Directions.* Below, you will find a number of statements, some of which are true and some of which are false. In each case, make a circle around the capital T if you think the statement is true, or make a circle around the capital F if you think the statement false. *Do not guess;* each incorrectly marked statement counts as a penalty against you.

T F 1. The teeth of a ripsaw look like this:



T F 2. The kind of saw used to cut with the grain of the wood is the ripsaw.

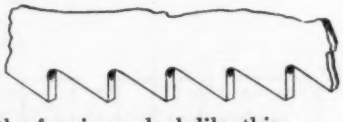
T F 3. The number on the heel of the saw refers to the number of teeth per inch in the saw.

T F 4. A ripsaw has less rake than a crosscut saw.

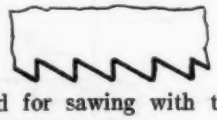
### Completion

*Directions.* Below you will find a number of incomplete questions. Insert, in the spaces provided, the information asked for.

1. The kind of saw represented by the sketch below is a (an) *ripsaw*.



2. The teeth of a ripsaw look like this:

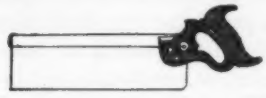


3. The saw used for sawing with the grain is the *ripsaw*.

4. Below are a number of drawings representing saws. Write the name of each in the blank at the right of the drawing.

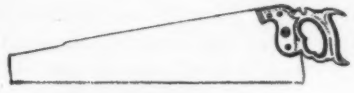
a) *backsaw* c) *handsaw*
b) *compass saw* d) *coping saw*

a)

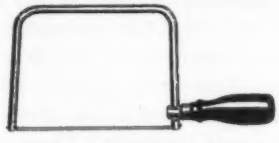


b)

c)



d)

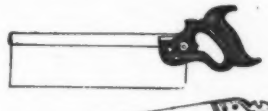


### Multiple-Choice

*Directions.* Below are a number of incomplete statements. After each statement there are several words or phrases, each preceded by a letter. You are to choose the right answer and write its letter in the parentheses left for this purpose at the right. Your score is based on the correct letters entered in the parentheses. No penalty is exacted for statements incorrectly marked.

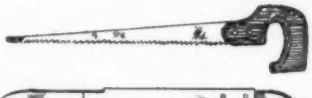
1. The number on the heel of the saw refers to:
   a) The length of the saw b) The number of teeth per inch
   c) The number of points per inch d) Manufacturer's catalog number ..... (c)
2. The saw to be selected for sawing with the grain where accurate fitting is required is the:
   a) backsaw b) panel saw
   c) compass saw d) hack saw ..... (a)
3. The saw to be selected for cutting tenons which require accurate fitting is the: ..... (a)

a)



b)

c)



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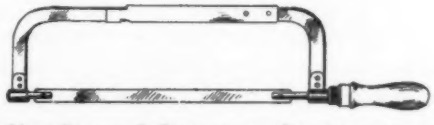
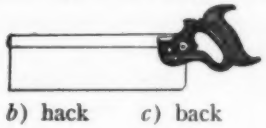


4. Underline the word that names the saw represented to the right.



a) compass b) hack c) back d) panel

5. The saw to be selected for the usual run of household work would be one having:
   *a*) 16 points per inch *b*) 12 points per inch
   *c*) 8 points per inch *d*) 5 points per inch (*c*)
6. Underline the names which are associated with the manufacturing of woodworkers' handsaws.
   Dietzgen, Starrett, Atkins, Disston, Yankee, Russell Jennings, Bishop, Oliver, Simmons, Yates-American.

Take first the question of the boy's ability to recognize the shape and name of saw teeth. Since but two fundamental shapes are involved, the multiple-choice type of questions is eliminated at the outset. It becomes now a question of whether the teacher should use a *true-false* or *completion* question to test this ability. This will be determined by his objectives in teaching. Question 1, True-False, involves the ability to recognize the shape of crosscut-saw teeth when a drawing of them is given. Question 1, Completion Type, requires in addition the recalling of the name as well as the recognition of the shape of the teeth, while Question 2, Completion Type, does not require the boy to know the name. It tests in addition to his ability to know the shape of teeth, the ability to pictorially represent the teeth. First, determine just what you expect the boy to know, and then in terms of this select the type of question to use in the test.

Next is the question of testing the boy's ability to select the proper saw to do a certain operation. Question 2, True-False, tests the ability to associate the name of the saw with the operation of ripping; Question 3, Completion, tests the ability to know the name of the saw to do ripping, whereas Question 2, Multiple-Choice, tests the ability to select from several names of saws the name of the proper saw to be used to do the process indicated, while Question 3, Multiple-Choice, requires that the student select from a number of sketches of saws that saw which is to be used for certain work. Question 5, Multiple-Choice, requires the selection of a saw to do certain work from a technical description of it.

Question 4, Completion, and No. 4, Multiple-Choice, test the ability to name a saw. In the completion question, the pupil is required to both associate the name with a tool and recall its name, whereas in the latter type, he is only required to associate the name with the sketch of the saw. Here again, it is a question of what the teacher wants to test. He will, of course, want to test what he has taught.

It will be seen from the foregoing discussion that the content covered in Question 6, Multiple-Choice, could be handled by True-False and Completion questions, but it would require several True-False questions to get the results obtained by this one question, and this material in completion form would require the student to remember the names of the firms. Consequently, in the light of the objections stated above, the Multiple-Choice type of question will best suit this material.

Let us approach the topic of adapting types of questions to objectives from still another angle. Instead of contrasting certain types of questions in one field, let us consider the possibilities of the different type of questions as applied to the various industrial-arts subjects. Certain phases of industrial-arts instruction lend themselves to variations of the type of questions discussed in the foregoing and to other types of questions not illustrated. Modifications of the completion question, the use of the diagram, the matching, and sequence types will be considered. Adaptations of these various types to different industrial-arts subjects follow. Matching-type questions adapt themselves to the testing of knowledge about what tools to use for certain operations, materials needed to do certain jobs, and the identification of terms, or of component parts, which make up larger units of machinery.

A variation of the completion-diagram type of question is very useful in testing constructions, wiring diagrams, interpretation of drawings, or testing the knowledge of the name of machine parts. Sequence questions are particularly useful in determining process orders.

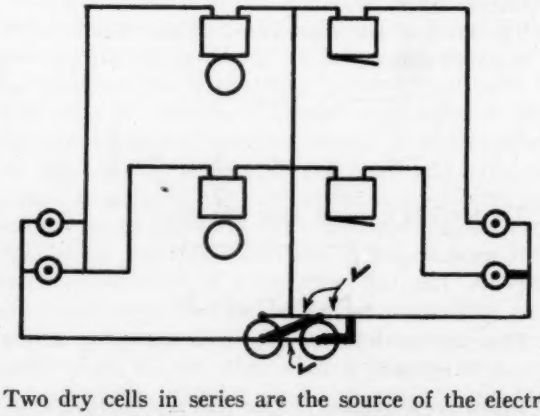
### Wood Constructions

A number of diagrams follow. There are three possibilities to think of in judging these diagrams; a diagram may be correct, a part may be missing, or a part may be put in incorrectly. If it is correct, mark

the figure O.K.; if a part is missing, insert the missing part; and if a part is incorrect, indicate the proper correction.

### Wiring Diagram

The wiring diagram shown herewith represents the bell and buzzer circuit of a two-apartment house.

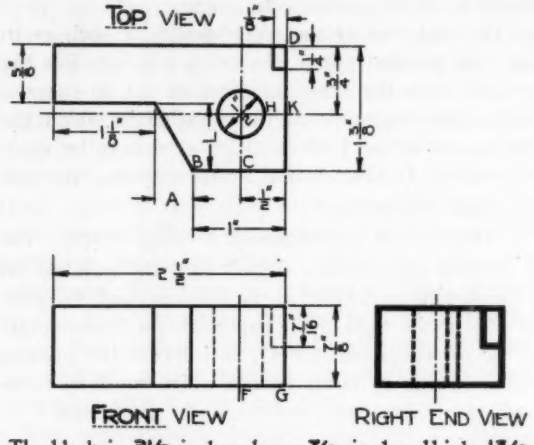


Two dry cells in series are the source of the electric energy for this circuit. The possibilities to consider are: Is the circuit correct? Is a part missing? Is a

part incorrect? If a part is missing, put it in; if a part is wrong, make the proper correction. If the entire circuit is correct, mark the diagram O.K.

### Interpretation of a Drawing

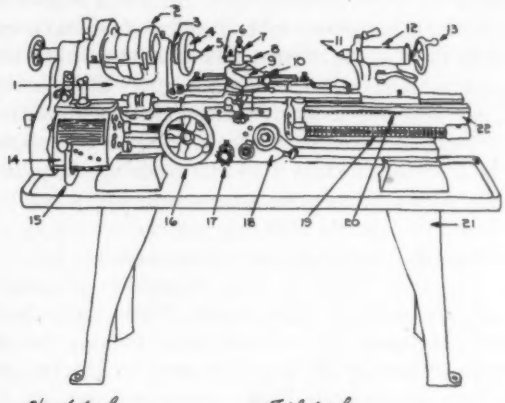
*Directions.* You are to do three things with the drawing of the block shown herewith. First, complete the right-end view. Second, fill in the name of the views not labeled. Third, fill in the blanks following the drawing so that the information asked for will be correctly given.




The block is 2½ inches long, ⅞ inches thick, 1⅜ inches wide; the diameter of the hole is ½ inches. Give the distances represented by the letters below: A ⅜" BC ½" HK ¼" KD ¾" FG ½" L ¾"

### Engine Lathe

Below is a drawing of a lathe. Parts of the lathe are numbered. In the blanks beneath the drawing, write the name of the part to which the numbered blank refers.



1. Headstock
2. Cone Pulleys
3. Live Spindle
4. Faceplate
5. Live Center
6. Cutting Tool
7. Tool Post
8. Tool Holder
9. Compound Rest
10. Feed Knob for Compound Rest
11. Dead Center
12. Tailstock
13. Tailstock Hand Wheel
14. Quick Change Gear Box
15. Quick Change Gear Lever
16. Hand Feed Wheel
17. Automatic Feed Knob
18. Split Nut Lever (Thread Cutting Lever)
19. Lead Screw
20. Rack
21. Legs
22. Bed

### Matching-Type Questions

*Directions.* In the left-hand column you will find a list of automobile parts, each one being numbered. In the column at the right you will find the units of a car to which they belong. Place the number of the part in the space before the unit to which it belongs.

Example:

| | |
|---|---|
| 1. Milk | (*2*) Chicken |
| 2. Feathers | (*1*) Cow |

| | |
|---|---|
| 1. Lemoine | ( *3*) Transmission |
| 2. Breaker Points | ( *5*) Rear Axle |
| 3. Triple Gears | (*10*) Battery |
| 4. Worm and Sector | ( *7*) Radiator |
| 5. ⅞ Floating | ( *1*) Front Axle |
| 6. Wrist Pins | ( *2*) Ignition System |
| 7. Honeycomb | ( *4*) Steering Gear |
| 8. Counterbalance | ( *6*) Pistons |
| 9. Armature | ( *8*) Crankshaft |
| 10. Electrolyte | (*13*) Carburetor |
| 11. Coil | |
| 12. Laminated | |
| 13. Venturi | |
| 14. Quadrant | |
| 15. Bendix | |

In order to reduce the possibility of guessing, it is suggested that one column of items be longer than the other and that a minimum number of ten items be placed in the shorter column. It is further suggested that a limit of twenty possible pairings be listed so that a minimum of time, consistent with adequate testing, be spent in hunting for the correct items to be matched.

### Sequence Question

The following is a list of operations necessary to be done in order to lock up a form for a platen press. Determine the order in which the operations should be performed and place the number of the steps in the parentheses at the right of each operation. Cleaning the surface of the imposing-table is the first thing done, so (*1*) has been placed after the operation. Determine the second operation to be performed and place (*2*) against that one. Continue in like manner with the remainder.

**Locking Up a Form for a Platen Press**

| | |
|---|---|
| Clean surface of imposing-table | ( *1*) |
| Place quoins in their proper positions | ( *7*) |
| Place the furniture around the form | ( *4*) |
| Tighten the quoins with quoin key | (*10*) |
| Test the form for lift | (*11*) |
| Build left and bottom sides solid with furniture | ( *6*) |
| Plane the form | ( *9*) |
| Tighten the quoins with your fingers | ( *8*) |
| Untie the job | ( *5*) |
| Place the chase around the form | ( *3*) |
| Slide the form on to the stone | ( *2*) |

It will be seen from the foregoing that the construction of a good test does not primarily consist in securing a number of questions of different types or a large number of questions of one type, but rather in the selection of the type or types of questions that fit the material or subject and parallel the course objectives.

There are, of course, other factors to be taken into consideration in the construction of a worth-while test. No article on test construction can ignore these factors, and we will give a brief, nontechnical discussion of them later. But it was felt that an extended discussion of the foregoing factors would be especially helpful to the classroom teacher, since they represent a point of view seldom touched upon by test experts.

The further factors to be considered are:

1. The test should be long enough to adequately sample the material being tested. Other things being equal, the longer the test the more reliable the test becomes. The time that can be used for the test and the type of material being tested will set for the teacher the limits as to the length of the test.

2. Care should be taken in the construction of the questions that no unit be ignored and also that for each unit tested no significant phase of that unit is omitted. A simple check on this is to make out a chart listing the items to be covered and checking the item by inserting the number of the question covering the item.

CHECK CHART

| | The Case | Type Characters | Setting Type | Spacing | Justification | Removing of Type | From Stick to Galley | Tying Forms | The Point System | Pulling Proof | Proofreading and Correcting | Distribution |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TRUE and FALSE | 14 15 16 17 | | 1 2 3 | 12 | 4 5 | | | 10 | 6 8 | | 11 19 20 | |
| COMPLETION | | | | | | | | | | | | |
| MULTIPLE CHOICE | | | | | | | | | | | | |
| MATCHING | | | | | | | | | | | | |

CHECK CHART ON A UNIT OF COMPOSITION, FIRST SEMESTER, JUNIOR HIGH SCHOOL

3. It was stated above that, "other things being equal," the longer the test the more reliable it becomes. However, length must not be secured by mere repetition. To illustrate: The writers received a test in woodwork from a group of classroom teachers in which the "thinner for varnish" was tested four times — by a true and false question, a completion question, a multiple-choice question, and a matching question. It is obvious that such a procedure will help to swell the length of a test but will not increase its reliability. On the other hand, since the time for examinations is limited, it is essential that there be no overlapping of questions in the various types, otherwise significant material may be omitted.

4. Test questions should be so constructed that no matter who scores the questions the score obtained would be the same — within the limits of human error. Particular care should be taken in this matter with the completion questions. Either the response called for in the blank must be definitely right or wrong or, where choices are possible, all choices must be given in the key used, and this key must be strictly adhered to when marking the papers.

5. The make-up of the tests should be such as to secure the greatest speed of scoring possible. For the true and false the best procedure seems to leave a blank at the beginning of the question in which the pupil inserts either T or N, or + or 0 may be used.

Example: T The initial letter makes the type page more interesting.

+ Material to be composed is called "copy." For the completion question, either word the question so the blank falls at the end of the question and the question ends at the right of the paper (this will necessitate the use of leaders at times), or indicate the missing word or words by short dashes which must be numbered where more than one occurs in a sentence.

Example:

A drawing of a machine or structure showing the relative positions of the different parts is called *assembly.*

Two cooling solutions which best meet the requirement for winter are 1 and 2 1. *alcohol*

2. *glycerine*

Good examples to use for the other types of questions are given in the illustrations used in the earlier part of the article.

6. Directions to the pupil must be clear and concise. It is a good plan to try the directions out on one or two pupils. Remember the test is not a test of the boy's ability to understand directions.

(To Be Continued)

SOUTH GERMAN CHEST (17TH CENTURY)
Metropolitan Museum of Art

# Reliability of Shop Teachers' Marks

*Louis V. Newkirk**

IT has been proved conclusively that there is wide variability in the subjective markings of the work done in the academic subjects.[1] Even a paper in arithmetic when marked by more than one hundred teachers showed wide variability. One teacher may give a paper A, another give the same paper F, and others B, C, D, etc. The question now arises, are we as subjective and as variable in the marks we assign to shop and drawing projects or can a shop teacher give more accurate marks because he has the actual object to take in his hands and examine? In order to get at least a partial answer to this question, the following study was carried through. Three woodworking projects, three drawings and three from sheet-metal projects were selected. These were actual projects taken from beginning classes and were not made especially for the experiment. There was an attempt to select one good project, one fair project, and one poor project in each of the three groups. The basis for this selection was to see whether or not teachers rate good projects more accurately than fair or poor ones.

The woodworking projects consisted of one gray wren house, one red wren house, and one rolling pin. The drawings were simple, inked drawings and were known as Nos. 1, 6, and 7. The sheet-metal projects consisted of three funnels which were numbered 1, 2, and 3.

The summer session offered an opportunity to have a group of experienced teachers rate the projects. The marking was done through individual or group conferences with the teachers and they did not observe the marks given by other teachers until after their marks had been recorded. The teachers were given all the time they wanted to mark the projects. They were given the following instructions:

1. Pay no attention to who made the projects, but rate them entirely on the basis of what you would consider perfect.

2. Rate the projects on a scale of 100; 100 for perfect, less for those less perfect.

3. List the factors that you took into consideration in rating the projects.

This required a simpler rating than would be necessary in an actual teaching situation, because it leaves out the factor of accomplishment by grades. The teacher had to rate the project only on the basis of what he considered perfect and did not have to rate it also as a seventh-, eighth-, or ninth-grade project. The factor of grades was avoided because the experimenter wished to find out how much variability there is among teachers in their concept of what is good workmanship. Consequently, this study has fewer variables than the actual teaching situation, so should be more reliable than one would expect to find on the job. This assumption is true if one will accept the hypothesis that the more variables involved, the more difficult the judgment.

In order to make comparisons with corresponding letters the following scale is used: A, 93–100; B, 87–93; C, 80–87; D, 73–80; and F below 73. This is only a rough means of comparison used to objectify the variability of the teachers' marks on the same project. The marks and rating factors obtained on beginning woodworking, drawing, and sheet-metal projects are given in the following six tables.

*University High School, State University of Iowa. Iowa City, Iowa.

[1]Starch, Daniel and Elliott, Edward C. *School Review*, 20:442–57; 21:254–59; 26: 676–81.

**Table I**
**Ratings and Frequencies for Woodwork**
**(39 teachers)**

| Red Wren House | | | Gray Wren House | | | Rolling Pin | | |
|---|---|---|---|---|---|---|---|---|
| *Rating* | *Frequency* | *Marks* | *Rating* | *Frequency* | *Marks* | *Rating* | *Frequency* | *Marks* |
| 81 | 1 | C | 96 | 1 | A | 98 | 1 | A |
| 80 | 3 | C | 95 | 5 | A | 96 | 1 | A |
| 78 | 4 | D | 94 | 1 | A | 95 | 6 | A |
| 75 | 10 | D | 92 | 3 | B | 94 | 2 | A |
| 74 | 1 | D | 90 | 11 | B | 93 | 2 | A |
| 73 | 1 | D | 87 | 1 | B | 92 | 3 | B |
| 70 | 3 | F | 85 | 12 | C | 90 | 14 | B |
| 65 | 2 | F | 80 | 2 | C | 85 | 2 | C |
| 61 | 2 | F | 75 | 2 | D | 83 | 1 | C |
| 55 | 1 | F | 70 | 1 | F | 80 | 1 | C |
| 53 | 1 | F | | | | 78 | 1 | D |
| 51 | 1 | F | | | | 75 | 3 | D |
| 50 | 6 | F | | | | | | |
| 40 | 3 | F | | | | | | |

The foregoing table ranges from 40 to 81 for the red wren house, 70 to 96 for the gray wren house and 75 to 98 for the rolling pin. There is also a tendency for the ratings to bunch at certain points on the scale. The letters show in a rough way that a pupil with the same project could get almost any of the variable passing marks depending upon the shop teacher who marked his project. It must be remembered that these results are not in all respects comparable to the actual situation in the shop or drawing room because the teacher would probably grade on the class average and it would also be necessary to take into consideration the physiological development of the pupils, their I. Q., mechanical aptitude, etc. There would also be the factor of the pupil's personality and class attitude which would affect the teacher.

**Table II**
**Rating Factors and Frequencies for the Three Woodworking Projects**
**(39 teachers)**

| *Rating Factors* | *Frequencies* |
|---|---|
| Finish | 31 |
| Joints | 30 |
| Proportion | 23 |
| Squareness | 22 |
| Nailing | 19 |
| Utilitarian | 13 |
| Commercial Standard or Workmanship | 13 |
| Design | 10 |
| Sanding | 8 |
| Fitting | 7 |
| Gluing | 5 |
| Dimensions | 4 |
| Choice of Materials | 4 |
| Planing | 4 |
| Shape | 4 |
| Accuracy | 3 |
| Boring | 2 |
| Cracks | 2 |
| Fastenings | 2 |
| Appearance | 2 |
| Neatness | 2 |
| Balance | 2 |
| Tool Processes | 2 |
| Construction | 2 |
| Strength | 2 |
| Assembly | 1 |
| Sawing | 1 |
| Angle | 1 |
| Degree of Difficulty | 1 |
| Smoothness | 1 |
| Tool Operations | 1 |
| Uniformity | 1 |
| Service | 1 |
| Matching | 1 |

There is a wide variation in the factors mentioned in scoring the same projects, but there is a distinct preference for rating factors which group themselves under the following headings: Results of tool operations, finish, design, fasteners and utility. It appears that much of the variation in rating is due to the varying amounts of emphasis placed on these rating factors.

Drawing No. 1 has a variation of 69, drawing No. 6 a variation of 58 and drawing No. 7 a variation of 24 points on the scale. As in the case of woodwork, a student with the same project could get all of the passing marks or complete failure depending upon his teacher. These ratings show more variation and less tendency to cluster than in the woodworking projects. The two poor drawings show the most variation and the best drawing the least, although No. 7 drawing has a variation equal to all the passing marks.

**Table IV**
**Rating Factors and Frequencies for the Three Drawings**
**(27 teachers)**

| *Rating Factors* | *Frequency* |
|---|---|
| Lettering and Figures | 62 |
| Lines | 62 |
| Neatness | 27 |
| Dimensions | 22 |
| Erasures | 18 |
| Arrowheads | 16 |
| Accuracy | 13 |
| Cleanliness | 8 |
| French Curves | 8 |
| Placement | 8 |
| Completeness | 7 |
| Spacing | 5 |

**Table III**
**Ratings and Frequencies for Three Beginning Drawing Projects**
**(27 teachers)**

| No. 1 | | | No. 6 | | | No. 7 | | |
|---|---|---|---|---|---|---|---|---|
| *Rating* | *Frequency* | *Mark* | *Rating* | *Frequency* | *Mark* | *Rating* | *Frequency* | *Mark* |
| 94 | 1 | A | 88 | 1 | B | 99 | 1 | A |
| 90 | 2 | B | 87 | 1 | B | 98 | 1 | A |
| 85 | 3 | C | 86 | 1 | C | 97 | 1 | A |
| 84 | 1 | C | 85 | 2 | C | 95 | 4 | A |
| 82 | 1 | C | 82 | 1 | C | 93 | 2 | A |
| 80 | 7 | C | 80 | 2 | C | 90 | 8 | B |
| 75 | 4 | D | 78 | 1 | D | 85 | 6 | C |
| 70 | 3 | F | 75 | 3 | D | 80 | 3 | C |
| 65 | 1 | F | 70 | 6 | F | 75 | 1 | D |
| 60 | 1 | F | 65 | 3 | F | | | |
| 40 | 1 | F | 60 | 1 | F | | | |
| 25 | 1 | F | 55 | 2 | F | | | |
| | | | 50 | 1 | F | | | |
| | | | 30 | 1 | F | | | |

| | |
|---|---|
| Projection | 5 |
| Joints | 4 |
| General Appearance | 4 |
| Inking | 3 |
| Shading | 3 |
| Title and Description | 3 |
| Border | 3 |
| Dashes | 3 |
| Proportion | 3 |
| Outline | 2 |
| Correctness | 2 |
| Incomplete | 2 |
| General Technique | 2 |
| Angle | 1 |
| Circle | 1 |

The drawing teachers show a decided preference for lettering and figures and lines, but they also take into consideration neatness, dimensions, erasures, arrowheads, and accuracy with fair consistency. The drawing teachers show a slightly greater variation than the woodworking teachers in their ratings.

Funnel No. 1 shows a variation of 50 points and marks varying from B to F with the scores scattered. Funnel No. 2 shows a variation of 25 points with marks varying from A to F, inclusive. Funnel No. 3 shows a variation of 38 points with marks varying from A to F, inclusive, with a slight tendency to cluster at B and C. Although this group includes only twelve teachers, the variability of the teachers' ratings is quite evident.

**Table VI**
**Rating Factors and Frequencies for Three Sheet-Metal Projects**
**(12 teachers)**

| *Rating Factors* | *Frequencies* | *Rating Factors* | *Frequencies* |
|---|---|---|---|
| Soldering | 33 | Roughness | 5 |
| Proportion | 13 | Joints | 4 |
| Seams | 13 | Curve | 2 |
| Roundness | 12 | Crimping | 2 |
| Shape | 11 | Lap Joint | 1 |
| Wiring | 9 | Smoothness | 1 |
| Neatness | 8 | Unevenness | 1 |
| Accuracy | 6 | Use of tools | 1 |
| Forming | 6 | Straightness | 1 |
| Design | 6 | Turning | 1 |

The above factors show a variation in the rating factors selected, but the results of tool operations and design are most frequent. As in the case of the woodworking and drawing teachers, the sheet-metal teachers select different rating factors in marking the same project.

The study indicates that shop and drawing teachers are not highly reliable in their ability to rate the same group of projects and drawings. There are not enough cases to say that shop and drawing teachers are more or less subjective in their markings than are the straight academic teachers. However, the study does indicate that they are at least the equal of the academic teachers in this unfortunate respect. The following table shows the range of ranking and the corresponding marks for the nine projects included in the study.

| *Project* | *Range of Rankings* | *Corresponding Marks* |
|---|---|---|
| Woodwork | 41; 26; 23 | C–F; A–D; A–D |
| Drawing | 69; 58; 24 | A–F; B–F; A–D |
| Sheet Metal | 50; 25; 38 | B–F; A–F; A–F |

The spread is a little smaller on the best projects and drawings, but the results are not adequate to warrant a definite conclusion, because even the better projects have a variation equal to the entire passing range — A–D inclusive.

The rating factors which the teachers put down are suggestive. Although there is marked variability in the factors used in rating there is also similarity. In woodworking, results of tool operations, finish, design, fasteners and utility stand out. In drawing, lettering and figures, dimensions, neatness and accuracy are noteworthy. In sheet metal, results of tool operations, proportion, fasteners and smoothness are outstanding.

The rating of shop projects and drawings is difficult and requires a complex judgment which includes a group of variable factors. The rating of shop projects and drawings is no different psychologically than rating an English theme or a paper in mathematics. In English the factors might be spelling, sentence structure, paragraphing, punctuation, etc., and in woodworking the rating factors might be results of tool processes, design, utility, finish, fasteners, etc.

Teachers vary greatly in their concept of what constitutes perfection in a project or a drawing. The same

**Table V**
**Rating and Frequencies for Three Sheet-Metal Projects**
**(12 teachers)**

| | No. 1 | | | No. 2 | | | No. 3 | |
|---|---|---|---|---|---|---|---|---|
| *Rating* | *Frequency* | *Mark* | *Rating* | *Frequency* | *Mark* | *Rating* | *Frequency* | *Mark* |
| 90 | 1 | B | 95 | 2 | A | 98 | 1 | A |
| 87 | 1 | B | 92 | 1 | B | 90 | 3 | B |
| 85 | 2 | C | 90 | 1 | B | 85 | 1 | C |
| 80 | 1 | C | 82 | 1 | C | 80 | 4 | C |
| 77 | 1 | D | 80 | 1 | C | 78 | 1 | D |
| 75 | 1 | D | 75 | 5 | D | 75 | 1 | D |
| 70 | 1 | F | 70 | 1 | F | 60 | 1 | F |
| 60 | 1 | F | | | | | | |
| 55 | 1 | F | | | | | | |
| 50 | 1 | F | | | | | | |
| 40 | 1 | F | | | | | | |

project or drawing looks different to different individuals. It may be possible to lessen the spread on shop and drawing teachers' marks through practice in judging projects with special reference to the factors which make up good workmanship in the various subject-matter divisions, but at present, teachers' marks on shop projects and drawings are no more reliable than the subjective marks in other instructional fields.

# An Accounting System for Testing

*J. Harold Brennan**

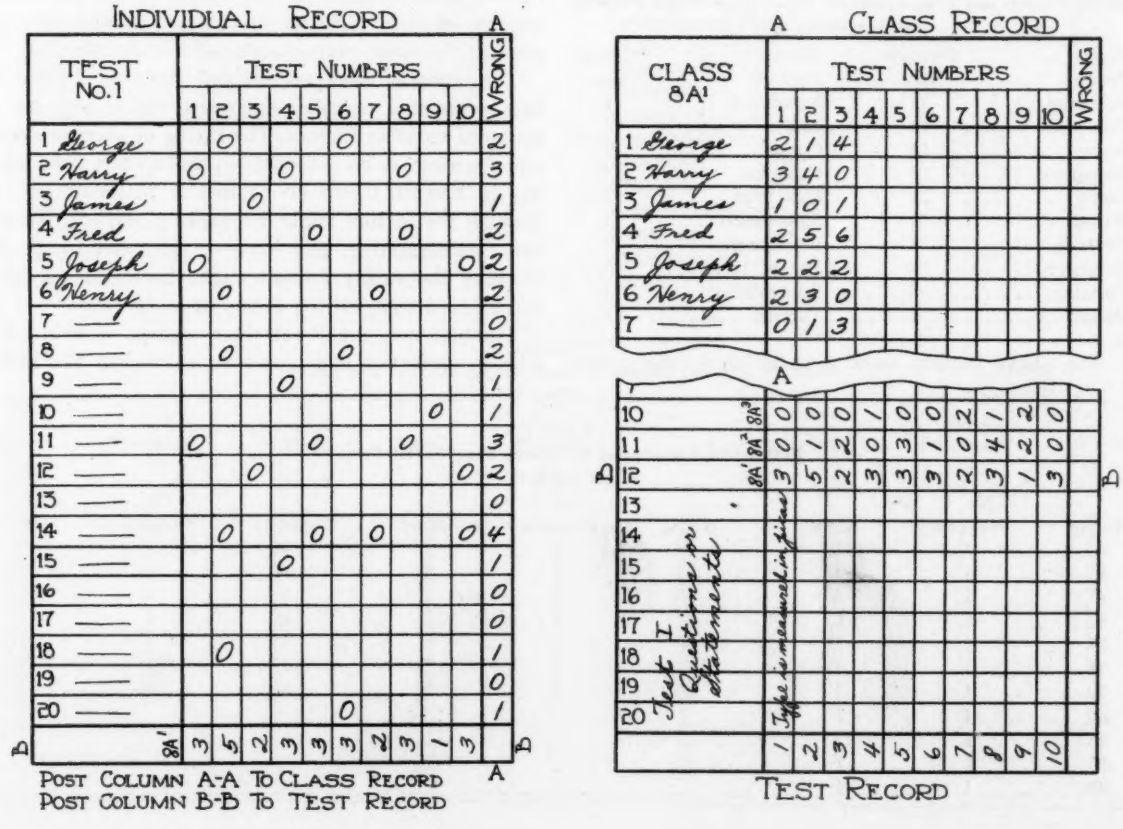
THE shop teacher who occasionally likes to test his students' information by a written test either of the true-and-false or completion type may find the accompanying rapid accounting system useful in relieving him of the monotony of excessive bookkeeping. This plan is designed for teachers who have several classes pursuing a similar type of work, and the aim is to test general items of information obtained by all classes taking the course.

The interesting items in this type of test are the records of individual students, records of the class as a unit, and records of the test throughout all classes in which it has been given.

Sufficient copies of the form represented by the individual record sheet are mimeotyped. This form is simply a sheet containing numbers down the side for the students' names and numbers across the top for the questions to be included in the tests. The column at the right is a summary column showing the number of questions missed by each student. The names are listed by the students in each class, care being taken to see that they are arranged in similar numerical order on each copy. After the tests are given and marked the questions missed by each student are represented by the zeros shown on the class record. The number of the test is written in the upper left-hand corner and one sheet is used in each class for each test which is given. The row at the bottom of the sheet shows the number of students missing each question.

A copy of the same form may be used as a class record for several tests. This is shown as marked in the upper half of the illustration. The names are listed similar to the individual sheet and the numbers at the top represent the tests given. Column A-A is posted under each test number by placing the individual sheet

*Junior High School, Amsterdam, New York.



directly alongside the class sheet and copying the figures. Students' progress in each test is shown as is also the record of the class in several tests. The last column may be used as a summary for each student.

The test record for one test in each class is represented in the sample at the bottom of the illustration. The actual questions given may be listed here in the spaces by the written numbers shown. Column B-B is posted in similar fashion to this sheet from the individual sheet for each class. Much of this recording may be done by a student secretary in each class.

The plan shows negative quantities, or questions missed, because this may be easier to record. The highest figures represent the weaknesses in student information and these may be an indication of points to be repeated in later lessons.

# A Mechanical-Drawing Test

*Harry W. Kroll**

THIS group of tests does not require the use of instruments and can be given separately during a part of a class period. All questions relative to the procedure in the test should be made clear before commencing.

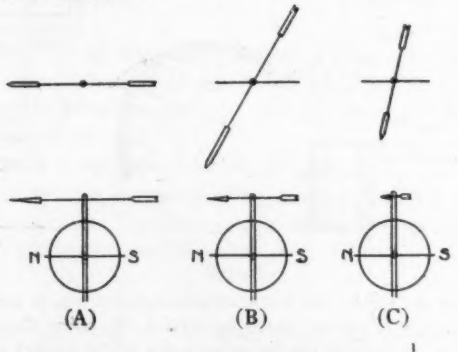
If a different order of inking has been taught, use that order in scoring your students. Likewise in scoring the other parts of Scale A, use the method which has been taught.

*General Directions:* This test is given to find out how much you have acquired regarding technical and related information in drawing. Read each question carefully and if you do not understand it, read it again; but do not guess, as there is a penalty for guessing which lowers your score. Do not waste time on one statement; come back to it if necessary. This is not a test to see how fast you can go, but how well you can judge each statement.

**Scale A-2 (Time 8 min.)**

*Part A*

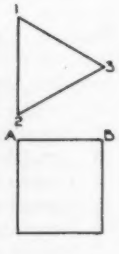
1. True-Length Lines. Two views of each weather vane are given. Which of the three vanes has the longest arrow, A, B, or C? Answer ———.




2. In the two views of the triangular prism the true distance of one side may be found on line a–b, 1–2, or 2–3. Which?———.

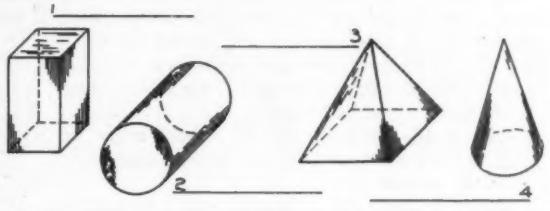
3. Draw free-hand the top view of the triangular prism just given in (2), in such a position that a–b on the front elevation will be the true distance of one side of the prism.

Make your drawing in this space.




*Part B*

1. Names of Solids. Write the name of each solid in the space provided.




2. Conic Sections. If a cone is cut by a plane perpendicular to its axis at (*a*), and is cut at an oblique angle at (*b*), what shape does the curve take in each?

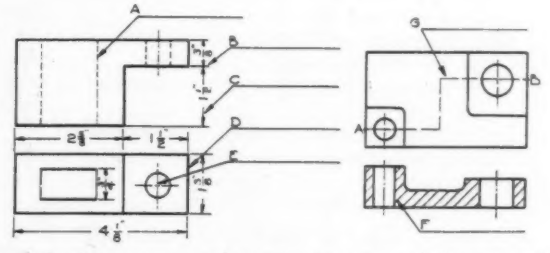
A———

B———

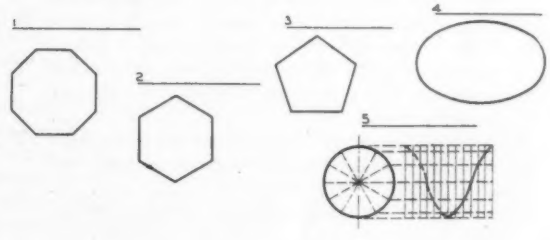
**Scale A-3 (Time 8 min.)**

*Part A*

1. Conventional Lines. In the following working drawings give the names of the lines to which each arrow points in the space provided.



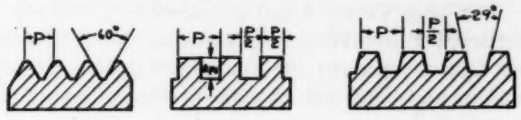

2. In the spaces provided write the names of the geometric constructions.



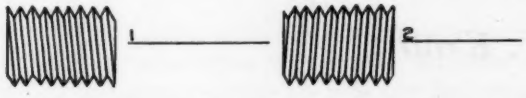

*Independent School District No. 35, Buhl, Minn.

*Part B*

1. Convention Thread Forms. Name the screw threads shown in the following profiles.




2. Indicate whether the thread forms (1) and (2) are left- or right-hand.

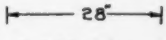



**Scale A-4, True-False Statements**

*Directions:* The statements below are either true or false. Make a ring around the T if you think the statement is correct, but if it is false, mark a ring around the F.

Sample: A T square is not used in drawing..... T (F)

1. The scale to which a drawing is made should never be placed in the title block..... T (F)
2. The small detail dimensions should never be placed nearest the object, with over-all dimensions on the outside ..... T (F)
3. When making a detail drawing with a number of machine parts on one sheet, use the same scale for all parts if possible..... (T) F
4. An auxiliary view of any part of a problem does not give the true shape or size of that part..... (T) F
5. In taking a cross section of any problem, it must always be shown on the right-side view..... T (F)
6. A view in half section shows the interior construction to a better advantage than a whole section ..... T (F)
7. In an assembly drawing containing a number of sectioned machine parts, the cross sectioning in adjacent pieces should be shown in opposite directions ..... (T) F
8. In order to draw a half or whole section of a problem, it must be cylindrical in shape..... T (F)
9. Broken lines showing hidden corners back of whole or half section may be omitted..... (T) F
10. When a problem is to be machined or finished it may be indicated thus (*f*)..... (T) F
11. All dimensions on isometric drawings may be taken on either horizontal or vertical lines..... (T) F
12. It is not good practice to place dimensions on center lines ..... (T) F
13. When a dimension on a problem should read twenty-eight inches, it should be placed thus:..... (T) F




14. A definite order of inking is not necessary in drawing ..... T (F)
15. When cutting through machine parts containing bolts, nuts, screws, arms of pulleys, and gear teeth for a sectional view, never cross-section these parts T (F)
16. When a scale of 3/16″ = 1—0″ is used, it is better to transfer the distance of ⅜″ with the dividers (T) F
17. A triangle having all of its sides equal is called an isosceles triangle ..... T (F)
18. A tapped hole is made with a twist drill and reamer T (F)
19. A square-head bolt used for ordinary purposes has U. S. Standard V threads..... T (F)
20. A bolt threaded at both ends is called a through bolt ..... T (F)
21. A square thread is used for bolts of small dimensions ..... T (F)
22. Blue prints are made without the use of tracing cloth or paper..... T (F)
23. When the ink on the drawing does not dry rapidly use a blotter..... T (F)
24. If a dimension on a problem is six feet no inches, it should be shown thus:..... (T) F

25. In transferring motion between two shafts at right angles to each other, bevel gears are employed.... (T) F
26. The small piece of metal driven into a slot on a pulley to keep it from slipping on the shaft is called a key..... (T) F
27. The outline formed by a plane cutting a cone parallel with the base is called an ellipse..... T (F)
28. One of two views of a cylinder forms a rectangle.. (T) F
29. Chalk dust may be used on tracing cloth to prepare the surface for inking..... (T) F
30. Water will harm the surface of tracing cloth.... (T) F

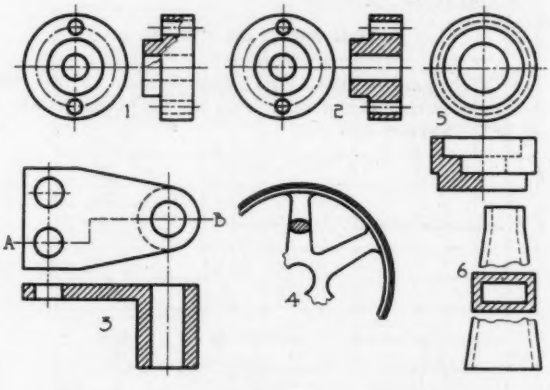
| | |
|---|---|
| Right ..... | Possible Score ..... |
| Wrong ..... | Not Attempted ..... |
| Omitted ..... | 2 X Wrong..... |
| Total ..... | Score ..... |

**Scale A-5** (*Time 10 min.*)

*Part A*

Conventional Sections. In the following group of working drawings showing sectional views, indicate to which each of the sectional views refers, in the column at the right of the list.

Front or side view in section..... ( )
Front or side view in partial section..... ( )
Front or side view in half section..... ( )
Broken section..... ( )
Revolved section..... ( )




*Part B*

Order of Inking. Mark the correct order in which the following steps in inking should be carried out, using the number given in front of the list as an index of the correct order. Example: Center lines should always be inked first, therefore, figure (2) comes first in the list. Select the next step and place that figure in the space below (2).

1. Circular arcs and circles..... (2)
2. Center lines ..... ( )
3. Vertical, horizontal, and oblique lines..... ( )
4. Irregular curves ..... ( )
5. Extension and dimension lines..... ( )
6. Dimensions, notes, and title..... ( )
7. Hidden circular arcs..... ( )
8. Hidden horizontal, vertical, and oblique lines..... ( )

9. Border line ..... ( )
10. Section or crosshatching lines..... ( )

**Key Scale A-2**

Possible Score Part A — 3 pts.
Possible Score Part B — 6 pts.

A — 1., (B) Credit 1 pt.
A — 2., 1–2 or 2–3 Credit 1 pt.
A — 3., Credit 1 pt.

B — 1:

| | |
|---|---|
| 1. Square Prism or Prism | Credit 1 pt. |
| 2. Cylinder | Credit 1 pt. |
| 3. Square Pyramid or Pyramid | Credit 1 pt. |
| 4. Cone | Credit 1 pt. |

B — 2:

| | |
|---|---|
| 1. Circle | Credit 1 pt. |
| 2. Ellipse | Credit 1 pt. |

**Key Scale A-3**

Possible Score Part A, 12 pts.
Possible Score Part B, 5 pts.

A — 1:

| | |
|---|---|
| A. Broken or dotted line | Credit 1 pt. |
| B. Extension or witness line | Credit 1 pt. |
| C. Dimension line | Credit 1 pt. |
| D. Object line | Credit 1 pt. |
| E. Center line | Credit 1 pt. |
| F. Sectioning or crosshatching line | Credit 1 pt. |
| G. Broken section line | Credit 1 pt. |

A — 2:

| | |
|---|---|
| 1. Octagon | Credit 1 pt. |
| 2. Hexagon | Credit 1 pt. |
| 3. Pentagon | Credit 1 pt. |
| 4. Ellipse | Credit 1 pt. |
| 5. Helix | Credit 1 pt. |

B — 1:

| | |
|---|---|
| A. U. S. Standard V Thread | Credit 1 pt. |
| B. Square Thread | Credit 1 pt. |
| C. Acme Thread | Credit 1 pt. |

B — 2:

| | |
|---|---|
| 1. Right-Hand Thread | Credit 1 pt. |
| 2. Left-Hand Thread | Credit 1 pt. |

**Key Scale A-4**

*True-False Statements. Possible Score, 30*

| | | |
|---|---|---|
| 1. F | 11. F | 21. F |
| 2. F | 12. T | 22. F |
| 3. T | 13. F | 23. F |
| 4. F | 14. F | 24. F |
| 5. F | 15. T | 25. T |
| 6. F | 16. T | 26. T |
| 7. T | 17. F | 27. F |
| 8. F | 18. F | 28. T |
| 9. T | 19. T | 29. T |
| 10. T | 20. F | 30. T |

**Key Scale A-5**

Possible Score Part A, 6 pts.
Possible Score Part B, 9 pts.

*Part A:*

| | | | |
|---|---|---|---|
| 2–3 | Credit 2 pts. | 6 | Credit 1 pt. |
| 1 | Credit 1 pt. | 4 | Credit 1 pt. |
| 5 | Credit 1 pt. | | |

*Part B:*

| | | | |
|---|---|---|---|
| 2 | Credit 1 pt. | 8 | Credit 1 pt. |
| 1 | Credit 1 pt. | 6 | Credit 1 pt. |
| 4 | Credit 1 pt. | 5 | Credit 1 pt. |
| 3 | Credit 1 pt. | 10 | Credit 1 pt. |
| 7 | Credit 1 pt. | 9 | Credit 1 pt. |

# Sample Woodworking Tests

*Nelson J. Murbach**

THE following tests may be offered singly for testing one particular phase of the work covered, or they may be given in groups to test the work carrying over a period of time.

The tests given here have been picked at random from our first-year woodworking course. They illustrate how tests of this sort can be devised to test the different phases of woodshop theory.

**Woodworking Test No. 2**

Complete the following statements concerning safety precautions:

1. Stand to the ——— of the work when ripping.
2. Always use ——— when ripping or dadoing.
3. Clear the top of the saw table of waste pieces with a ——— not with your ———.
4. Do not attempt to joint pieces under ——— in length.
5. Push your work clear by the cylinder head before attempting to ——— it from the ——— table.
6. Do not attempt to cut off ——— pieces on the band saw.
7. Do not joint ——— ——— of wood.
8. Do not attempt to saw extremely ——— ——— on the variety saw.
9. Never reach over the ——— to make ——— while it is in motion.
10. When in doubt about a machine operation ask ———.

**Woodworking Test No. 3**

The following list contains the names of parts belonging to different machines in our woodshop. Write the number of the machine to which the part belongs in the parentheses shown opposite the name of the part. The machine numbers are as follows:

1. Variety saw
2. Band saw
3. Jointer
4. Lathe
5. Grindstone

**Machine Parts**

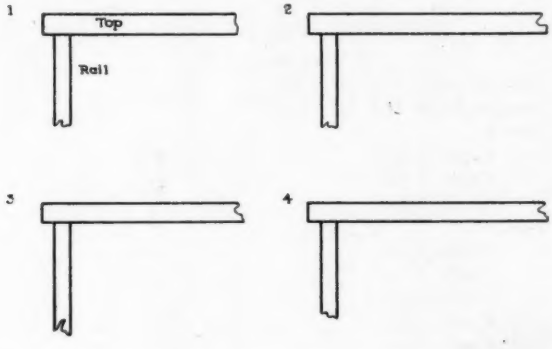
1. Micrometer adjustment ..... ( )
2. Dead center ..... ( )
3. Saw arbor ..... ( )
4. Saw mandrel..... ( )
5. Cylinder head..... ( )
6. Saw slitting guard..... ( )
7. Saw cover guard..... ( )

*Junior-Senior High School, Batavia, N. Y.

8. Knives ..... ( )
9. Ripping fence ..... ( )
10. Gauge block ..... ( )
11. Saw-tension adjustment ..... ( )
12. Headstock ..... ( )
13. Faceplate ..... ( )
14. Speed control ..... ( )
15. Crosscutting fence ..... ( )
16. Toolrests ..... ( )
17. Table-leveling adjustment ..... ( )
18. Fence-tilting adjustment ..... ( )
19. Table extension ..... ( )
20. Saw guides ..... ( )
21. Rolling table ..... ( )
22. Dado cutters ..... ( )
23. Rubber-covered wheels ..... ( )
24. Gauge rods ..... ( )
25. Raising and lowering wheels ..... ( )

**Woodworking Test No. 5**

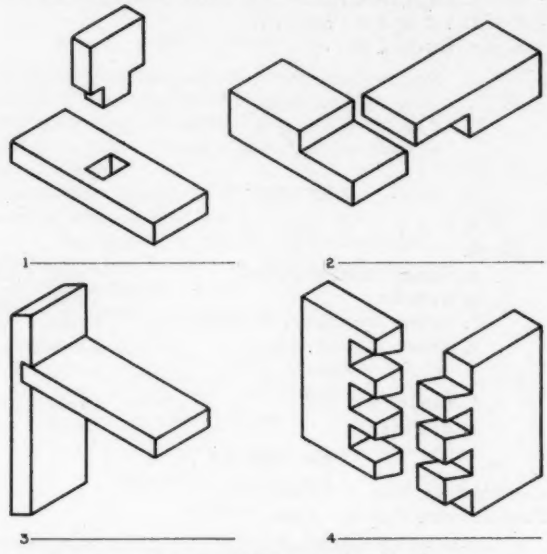
A. On the following sketches indicate four ways of fastening table tops.




B. Fill in the following statement:
In the preceding drawing, number ——— shows the best way of fastening a table top in place because it provides for the ——— in the table top.

**Woodworking Test No. 8**

A. Indicate what type of joints the following are:




B. Draw two types of joints not already given.
(Leave space for student's drawing)

# A Pretest for Beginners in Mechanical Drawing

*E. C. Wittick**

IN introducing a course it is usually necessary to give some preliminary instruction in the terminology which will be encountered. Some teachers say, "Teach the meaning of the words as they come up." But, how many teachers are astute enough to know, or to find out during a lecture, just which words are not known to this or that pupil? The best that can be done in any case is to try to locate all the words that may be troublesome to the pupil, and acquaint him with their meaning just before he is to use them.

A good way to arouse the pupil's interest in any subject is to make the pupil conscious of a lack of information regarding it, and at the same time show him the necessity of having that information. The writer, therefore, designed the following test which is given on the first day that the class in mechanical drawing meets, before any lecture or discussion is given. In order to get the pupils to do their best on the first attempt, the purpose of the test is not explained until later. In general, the pupils know the meanings of so few of the words that they readily see the need for instruction after they have taken the examination.

The test papers are returned to the students for inspection, and then a recitation is conducted in which the meaning of each word is clearly illustrated.

On the day following the class recitation, the same test is then repeated, to make sure that every pupil has learned the subject matter. Usually the results are gratifying. Those pupils who experience trouble in the second attempt usually turn out to be problem cases.

### The Test

The test was made up by careful inspection of several mechanical-drawing textbooks for the purpose of picking out a list of unfamiliar words and phrases peculiar to mechanical

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drawing. The written type of test was preferred by the writer because it helps the student to clarify his ideas on this subject a little better than a new-type test would.

**Test**

*Directions:*

1. Answer all questions briefly and concisely.
2. Number all answers.
3. Write the heading for each section.
4. Use sketches only when necessary to complete written answers.

I. *Lines and Geometrical Terms*

Give definition of:

1. Vertical line.
2. Horizontal line.
3. Perpendicular line.
4. Converging lines.
5. Diagonal line.
6. Parallel lines.
7. Tangent line.
8. Radius.
9. Arc.
10. Diameter.
11. Circumference.
12. Intersecting line.

II. *Angles*

Give definition of:

1. Right angle.
2. Acute angle.
3. Obtuse angle.
4. External angle.
5. Internal angle.

III. *Shapes and Geometrical Terms*

Give definition of:

1. Triangle.
2. Square.
3. Rectangle.
4. Parallelogram.
5. Hexagon.
6. Octagon.
7. Pentagon.
8. Ellipse.
9. Circle.
10. Cube.
11. Sphere.
12. Pyramid.
13. Cone.
14. What is meant by "truncated"?
15. What is meant by "frustrum of a cone or pyramid"?

IV. *Lines Used in Drawing*

Describe, tell use of, and illustrate:

1. Border line.
2. Visible outline.
3. Invisible outline.
4. Center line.
5. Extension line.
6. Projection line.
7. Dimension line.
8. Break line.
9. Limiting break line.
10. Cutting plane line.

V. *Miscellaneous*

1. What is meant by a "view"?
2. Describe and indicate relationship in regard to relative position:
   *a*) Front View
   *b*) Top view
   *c*) End view
   *d*) Sectional view.
3. What is meant by projection?
4. What is meant by orthographic projection?
5. What is a perspective drawing?
6. What is an isometric drawing?
7. What is a working drawing?

# Checking the Student's Work

*W. R. Challoner**

THIS method of using checking lists and the master check sheet described herewith has been used for some time and has been found a very helpful teaching aid.

The object of these lists is to provide a medium for both teaching and checking, and one that could be used in the shop without wasting the teacher's time. It also causes the student to review the job just completed and helps him retain the names of materials, tool operations, machines, or important parts of tools and power machinery.

The method used to accomplish this is simple and accurate. The same check list will do for several jobs. The master check sheet is easily made by punching the list for items used on a given job. For the sake of durability, the master sheet should be printed on 3- or 4-ply fiber board or pasted to same before it is punched.

When correcting the sheet, place the list on which the student has marked an X after each item which he considers correct, on a check board, with a master check sheet over it. This board consists of a piece of wood a little larger than the sheet with a strip projecting one fourth of an inch above the board on the top and right-hand side, forming a corner which brings the sheets in proper relation with each other.

To correct the sheet, place a ruler or a card so that the edge covers half of the hole and draw a line. This

CHECK LIST

STUDENTS NAME_____ GRADE_____

JOB_____ TIME SPENT IN HOURS_____

In making this job you used some of the items in the following list.
Put a [X] in the square after the ones you can recall. ERRORS_____

| MATERIALS | | TOOLS | | OPERATIONS | | MACHINES | |
|---|---|---|---|---|---|---|---|
| Brass | | Hammer | ○ | Rough & Finish Turning | ○ | Grinder or Emery Wheel Stand | |
| Bronze | | Prick Punch or Center Punch | ○ | Facing | ○ | Lathe | ○ |
| Babbitt | | Screw Driver | | Sawing | ○ | Milling Machine | |
| Aluminum | | Scratch Awl or Scriber | ○ | Filing | ○ | Shaper | |
| Carbon Tool Steel | ○ | Divider | | Cleaning Up Work Place | ○ | Planer | |
| High Speed Tool Steel | ○ | Scale | ○ | Lasout Work | | Power Hacksaw | ○ |
| Mach. Steel or Mild Steel | ○ | Drawing or Blue Print | ○ | Drilling | ○ | Drill Press | ○ |
| Cold Rolled Steel | | Cold Chisel | | Prick Punching Center Punching | ○ | Bench or Sensitive Drill Press | ○ |
| Alloy Steels | | Twist Drill | ○ | Measuring | ○ | Speed Lathe | ○ |
| Hot Rolled Steel | ○ | Reamer | | Grinding | | Universal Grinder | |
| Tin | | Clamps | | Chiseling or Chipping | | Forge | ○ |
| Wood | ○ | Vise | ○ | Polishing | ○ | Part of Machine Tool You Should Be Able to Locate | |
| Cast Iron or Gray Iron | | Mill or Bastard File | ○ | Stamping | | Lathe Head Stock | |
| Cast Steel | | Caliper | ○ | Bench Work, Running Lathe, Shaper, Drill Press | ○ | Tail Stock | |
| Kmry | | Emery Cloth | ○ | Scribing | | Bed | |
| Crucible Steel | | Gauges or Different Kinds | ○ | Centering | ○ | Carriage | |
| Copper | ○ | Wrenches | | Knurling | ○ | Driver Plate | |
| Lead | | Micrometers | | Boring | | Live Center | |
| Emery Cloth | ○ | Template | | Reaming | | Dead Center | |
| White Lead | ○ | Hacksaw Frame | ○ | Taper Turning | ○ | Cone Pulley | |
| Cloth | | Drill Chuck | ○ | Checking & Tracing Up Work | ○ | Back Gear | |
| Machine Oil | ○ | Square Centerhead or Bevel Protractor | ○ | Case Hardening | | Tool Post | |
| Cutting Oil or Compound | ○ | Morse Taper Socket | ○ | Tool Grinding | | Hand Wheel | |
| Card Board | ○ | Taps—Die & Stock or Screw-Plate | | Tool Setting | ○ | Change Gears | |
| Rivets | | Steel Figures & Letters | | Bench Work | ○ | Lead Screw | |
| Screws & Bolts | | Forge or Anvil | ○ | Hardening & Tempering | ○ | Compound Rest | |
| Case Hardening Compound | | Mandrel | | Drawing | | Cross Slide | |
| Leather | | Lathe Dog | ○ | Forming Parts | ○ | Apron | |
| Copper Oxide or Blue Vitriol | | Tool Holder | ○ | Reading Drawing or Blueprint | ○ | Spindle | |
| | | | | | | Gear Guard | |
| | | | | | | Shifter Lever | |
| | | | | | | Feed Knob | |
| | | | | | | Micrometer Dial | |
| | | | | | | Ram | |
| | | | | | | Tool Slide | |
| | | | | | | Lift Screw | |
| | | | | | | Table or Knee | |
| | | | | | | Ratchet Feed | |
| | | | | | | Stanke Set | |
| | | | | | | Crank | |
| | | | | | | Housing | |
| | | | | | | Compound Slide | |
| | | | | | | Vise & Swivel Base | |
| | | | | | | Countershaft | |
| | | | | | | Steady Rest | |
| | | | | | | Chuck or Bar | |

FIG. 1. MASTER SHEET WITH PUNCHED HOLES

*Machine-Shop Instructor, Appleton Vocational School, Appleton, Wis.

**CHECK LIST**

STUDENTS NAME John Brown GRADE B

JOB Tool Grinder TIME SPENT IN HOURS 1

In making this job you used some of the items in the following list.
Put a [X] in the square after the ones you can recall. ERRORS

| MATERIALS | | TOOLS | | OPERATIONS | | MACHINES | |
|---|---|---|---|---|---|---|---|
| Brass | | Hammer | X | Rough & Finish Turning | X | Grinder or Emery Wheel Stand | |
| Bronze | | Prick Punch or Center Punch | X | Facing | X | Lathe | X |
| Babbitt | | Screw Driver | | Sawing | | Milling Machine | |
| Aluminum | | Scratch Awl or Scriber | | Filing | X | Shaper | |
| Carbon Tool Steel | X | Divider | | Cleaning Up Work Place | | Planer | |
| High Speed Tool Steel | X | Scale | X | Layout Work | | Power Hacksaw | X |
| Mach. Steel or Mild Steel | X | Drawing or Blue Print | | Drilling | X | Drill Press | X |
| Cold Rolled Steel | | Cold Chisel | | Prick Punching Center Punching | | Bench or Sensitive Drill Press | |
| Alloy Steels | | Twist Drill | X | Measuring | | Speed Lathe | X |
| Hot Rolled Steel | X | Reamer | X | Grinding | | Universal Grinder | |
| Tin | | Clamps | | Chiselling or Chipping | | Forge | X |
| Wood | X | Vise | | Polishing | X | Part of Machine Tool You Should Be Able to Locate | |
| Cast Iron or Gray Iron | | Mill or Bastard Files | X | Stamping | | Lathe Head Stock | |
| Cast Steel | X | Caliper | | Bench Work, Running Lathe, Shaper, Drill Press | | Tail Stock | |
| Emery | | Emery Cloth | X | Scribing | | Bed | |
| Crucible Steel | | Gauges of Different Kinds | | Centering | X | Carriage | |
| Copper | X | Wrenches | | Knurling | | Driver Plate | |
| Lead | | Micrometers | | Boring | | Live Center | |
| Emery Cloth | X | Template | X | Reaming | | Dead Center | |
| White Lead | | Hacksaw Frame | X | Taper Turning | X | Cone Pulley | |
| Chalk | | Drill Chuck | | Checking & Truing Up Work | | Back Gear | |
| Machine Oil | X | Square Centerhead or Bevel Protractor | X | Case Hardening | | Tool Post | |
| Cutting Oil or Compound | | Morse Taper Socket | | Tool Grinding | | Hand Wheel | |
| Card Board | | Taps—Die & Stock or Screw-Plate | | Tool Setting | X | Change Gears | |
| Rivets | | Steel Figures & Letters | | Bench Work | | Lead Screw | |
| Screws & Bolts | | Forge or Anvil | X | Hardening & Tempering | X | Compound Rest | |
| Case Hardening Compound | | Mandrel | | Drawing | | Cross Slide | |
| Leather | | Lathe Dog | | Forming Parts | X | Apron | |
| Copper Oxide or Blue Vitriol | | Tool Holder | X | Reading Drawing or Blueprint | | Spindle | |
| | | | | | | Gear Guard | |
| | | | | | | Shifter Lever | |
| | | | | | | Feed Knob | |
| | | | | | | Micrometer Dial | |
| | | | | | | Ram | |
| | | | | | | Tool Slide | |
| | | | | | | Lift Screw | |
| | | | | | | Table or Knee | |
| | | | | | | Ratchet Feed | |
| | | | | | | Stroke Set | |
| | | | | | | Crank | |
| | | | | | | Housing | |
| | | | | | | Compound Slide | |
| | | | | | | Vise & Swivel Base | |
| | | | | | | Countershaft | |
| | | | | | | Steady Rest | |
| | | | | | | Clapper Box | |

FIG. 2. CHECK LIST WITH STUDENT'S MARKINGS

**CHECK LIST**

STUDENTS NAME John Brown GRADE B

JOB Tool Grinder TIME SPENT IN HOURS 1

In making this job you used some of the items in the following list.
Put a [X] in the square after the ones you can recall. ERRORS 24

| MATERIALS | | TOOLS | | OPERATIONS | | MACHINES | |
|---|---|---|---|---|---|---|---|
| Brass | | Hammer | X | Rough & Finish Turning | X | Grinder or Emery Wheel Stand | |
| Bronze | | Prick Punch or Center Punch | X | Facing | X | Lathe | X |
| Babbitt | | Screw Driver | | Sawing | ✓ | Milling Machine | |
| Aluminum | | Scratch Awl or Scriber | ✓ | Filing | X | Shaper | |
| Carbon Tool Steel | X | Divider | | Cleaning Up Work Place | ✓ | Planer | |
| High Speed Tool Steel | X | Scale | X | Layout Work | | Power Hacksaw | X |
| Mach. Steel or Mild Steel | X | Drawing or Blue Print | ✓ | Drilling | X | Drill Press | X |
| Cold Rolled Steel | | Cold Chisel | | Prick Punching Center Punching | ✓ | Bench or Sensitive Drill Press | ✓ |
| Alloy Steels | | Twist Drill | X | Measuring | ✓ | Speed Lathe | X |
| Hot Rolled Steel | X | Reamer | X ✓ | Grinding | | Universal Grinder | |
| Tin | | Clamps | | Chiselling or Chipping | | Forge | X |
| Wood | X | Vise | ✓ | Polishing | X | Part of Machine Tool You Should Be Able to Locate | |
| Cast Iron or Gray Iron | | Mill or Bastard Files | X | Stamping | | Lathe Head Stock | X |
| Cast Steel | X ✓ | Caliper | ✓ | Bench Work, Running Lathe, Shaper, Drill Press | ✓ | Tail Stock | X |
| Emery | | Emery Cloth | X | Scribing | | Bed | X |
| Crucible Steel | | Gauges of Different Kinds | ✓ | Centering | X | Carriage | |
| Copper | X | Wrenches | | Knurling | ✓ | Driver Plate | X |
| Lead | | Micrometers | | Boring | | Live Center | |
| Emery Cloth | X | Template | X ✓ | Reaming | | Dead Center | X |
| White Lead | ✓ | Hacksaw Frame | X | Taper Turning | X | Cone Pulley | |
| Chalk | | Drill Chuck | ✓ | Checking & Truing Up Work | ✓ | Back Gear | |
| Machine Oil | X | Square Centerhead or Bevel Protractor | X | Case Hardening | | Tool Post | X |
| Cutting Oil or Compound | ✓ | Morse Taper Socket | ✓ | Tool Grinding | | Hand Wheel | |
| Card Board | ✓ | Taps—Die & Stock or Screw-Plate | | Tool Setting | X | Change Gears | X |
| Rivets | | Steel Figures & Letters | | Bench Work | ✓ | Lead Screw | |
| Screws & Bolts | | Forge or Anvil | X | Hardening & Tempering | X | Compound Rest | |
| Case Hardening Compound | | Mandrel | | Drawing | | Cross Slide | |
| Leather | | Lathe Dog | ✓ | Forming Parts | X | Apron | |
| Copper Oxide or Blue Vitriol | | Tool Holder | X | Reading Drawing or Blueprint | ✓ | Spindle | |
| | | | | | | Gear Guard | |
| | | | | | | Shifter Lever | |
| | | | | | | Feed Knob | |
| | | | | | | Micrometer Dial | |
| | | | | | | Ram | |
| | | | | | | Tool Slide | |
| | | | | | | Lift Screw | |
| | | | | | | Table or Knee | |
| | | | | | | Ratchet Feed | |
| | | | | | | Stroke Set | |
| | | | | | | Crank | |
| | | | | | | Housing | |
| | | | | | | Compound Slide | |
| | | | | | | Vise & Swivel Base | |
| | | | | | | Countershaft | |
| | | | | | | Steady Rest | |
| | | | | | | Clapper Box | |

FIG. 3. STUDENT'S CHECK LIST MARKED BY THE TEACHER

will give a vertical mark in each square after the items that should be checked and indicates the correct answers. Therefore, wherever an X and a vertical mark appear on the student's check sheet, the answer is correct; if only a cross appears the answer is wrong and should be checked with a check (✓) mark. If only a vertical mark appears the answer also is wrong and should be checked. By counting the check marks, the number of errors is obtained. A little study of Figures 1, 2, and 3, show how simple this checking system really is.

Figure 1 shows the master check sheet with holes punched so that a mark can be made through them at the correct place. Figure 2 shows the check list after student has marked it, and Figure 3 shows the same sheet after the teacher has checked it.

In the lower half of column 4 are listed parts of machine tools that the student should be able to locate. This furnishes a splendid opportunity for the instructor to see how observing a student is and how much he gathered from the demonstration and lecture that went with the job.

# Machine-Shop Test

*George C. Donson**

### Matching Test

*Directions:* Place in the parentheses at the right of each word or phrase in the right-hand column the number of the word or phrase in the left-hand column of the same group which is associated with that word or phrase.

| | |
|---|---|
| 1. Universal chuck | (*23*) Moves the carriage |
| 2. Dog | (*33*) Adjustable wrench |
| 3. Saddle | (*40*) Finish |
| 4. Chasing tool | (*31*) To make threads outside |
| 5. Q.C.G. | (*35*) To make work rough |
| 6. Gib | (*36*) Single cut |
| 7. Taper | (*30*) To make threads on the inside |
| 8. Spur gear | (*25*) To test thread-cutting tool |
| 9. Lead screw | (*26*) In headstock spindle |
| 10. Squaring-up tool | (*28*) Used to remove drill sleeve |
| 11. Divider | (*38*) A device |
| 12. Steady post | (*24*) Used to measure the 1,000ths of an inch |
| 13. R.P.M. | (*37*) Used on taper drills |
| 14. S.A.E. | (*39*) Lineal feet per minute |
| 15. Follower rest | (*32*) To hold a tap |
| 16. Compound rest | (*27*) Cutting tool |
| 17. C.R.S. | (*34*) A drill with included angle of 60 deg. |
| 18. Dial | |
| 19. Clearance | (*29*) Used to test diameter |
| 20. Rocker | (*10*) For making a 90-deg. angle |

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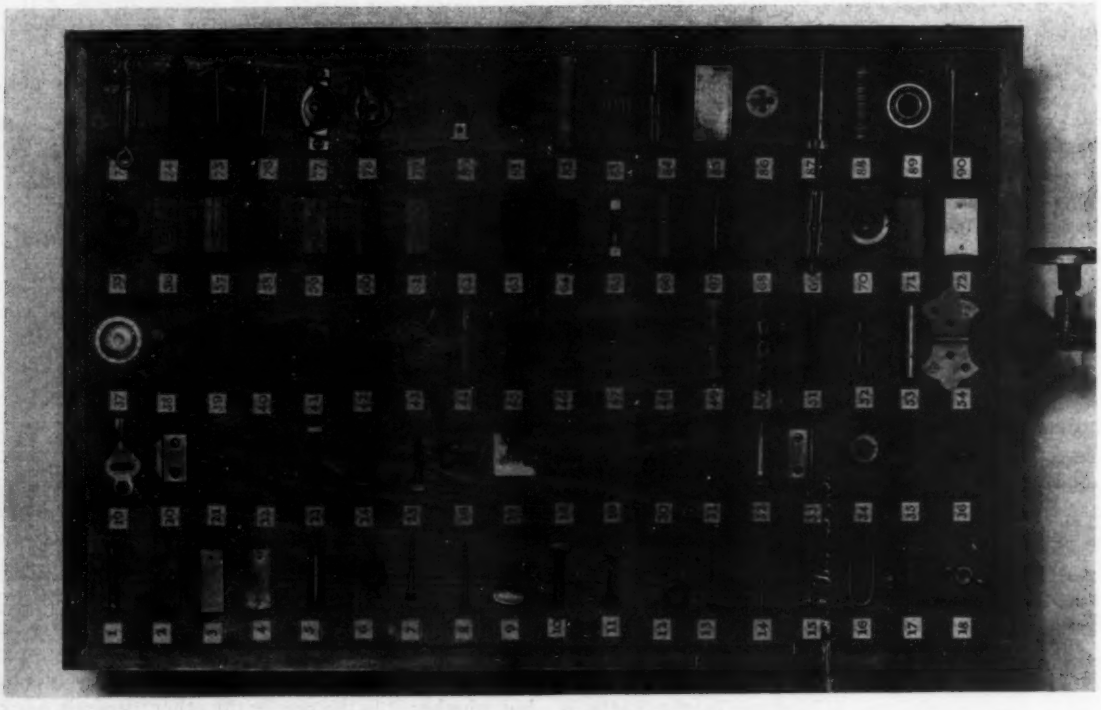
21. U.S.S.
22. Shears
23. Feed rod
24. Micrometer
25. Center gauge
26. Live center
27. Tool bit
28. Drift
29. Plug gauge
30. Tap
31. Die
32. Tap wrench
33. Crescent wrench
34. Countersink drill
35. Knurl
36. Mill file
37. Drill sleeve
38. Shop kink
39. Surface speed
40. F.
41. Mandrel
42. Oxide of lead
43. Center grinder
44. A.S.M.E.
45. Morse taper

(*18*) Shows position of lead screw
(*13*) Revolution per minute
(*16*) Part of carriage
(*20*) Used to give tool and angle
(*17*) Cold-rolled steel
(*19*) Rake
(*11*) A machinists' hand tool
( *6*) To adjust a slide
( *3*) A beveled ring
( *5*) Quick-change gears
( *8*) Teeth parallel with axis
(*12*) Used between centers
(*14*) Society of Automobile Engineers
(*15*) Used on carriage
(*21*) United States Standard
( *7*) Morse taper
( *2*) To remove work between centers
(*22*) On the lathe bed
( *9*) Usually has square thread
( *4*) Used in cylinder turning
( *1*) To hold round work

## Recognition Test

*Directions:* List the number and name of each object found on the display board illustrated herewith. Be definite in your answers. For example: No. 7 is a flat-head, bright, wood screw No. 10, 2 in. long.

1. Copper tubing
2. Cast iron
3. Aluminum
4. Babbitt
5. Brass
6. Pack nut for spark plug
7. Flat-head, bright, wood screw No. 10, 2 in. long
8. Oval-head wood screw No. 10, 2 in. long
9. Thumb screw
10. Machine bolt
11. Carriage bolt
12. Pipe bushing
13. Cut nail
14. 8-Penny wire nail
15. Box nail
16. Staple
17. Finishing nail
18. Wing nut
19. Skate key
20. Sash lift
21. Fillister-head machine screw
22. Machine screw
23. Stove bolt
24. Awning hook
25. Lag screw
26. S.A.E. cap screw
27. Corner brace
28. Roofing nail
29. Glazier points
30. Belt hook
31. Wedge for handles
32. Horseshoe nail
33. Butt hinge
34. Lock washer
35. Cotter pin
36. Screw eye
37. Roofing cap
38. Setscrew
39. Harness rivet
40. U.S.S. cap screw
41. Washer
42. Split rivet
43. Acid core solder
44. Tool bit
45. Pipe reducer
46. Fuse wire
47. Safety set screw
48. Twist drill
49. Sash cord
50. Sash chain
51. Loom
52. Fuse for automobile
53. Cold-rolled steel
54. Butterfly hinge
55. Castle nut
56. Oak
57. Yellow pine
58. Walnut
59. Chestnut
60. Cherry
61. White pine
62. Pressed wood
63. Red fiber
64. Piece of carbon
65. S.A.E. hexagon-head bolt
66. Dowel pin
67. Tap
68. Washer for faucet
69. Toggle bolt
70. Spiral gear
71. Piece of leather
72. Bright tin
73. Turn buckle
74. Insulated wire
75. Flooring nail
76. Countersink drill
77. Sash lock
78. Sash pulley
79. Emery-wheel dressers
80. Rotor
81. Spur gear
82. Porcelain tube
83. Corregated fastener
84. Reamer
85. Galvanized iron
86. Die
87. Stair rail bolt
88. BX cable
89. Ball bearing
90. Gimlet



MATERIALS DISPLAY BOARD

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. METZ, Editor

## IMAGINE HIS EMBARRASSMENT

"If you don't come down from up there right away, you blankety blank fool, I'll come up there and break your neck." Such was the gentle hint used by one teacher in intimating to one of his students that he wanted him to come from the upper story of a demonstration house in an electrical department as fast as possible.

Naturally the boy spoken to acted on the teacher's suggestion. Naturally also, the other boys in the class listened to the teacher's exhortation with protruding eyes and sagging jaws. They stood at attention, as it were, while the stern-visaged mentor watched with eyes that glistened with anger as the culprit descended.

Then came a gasp from one of the boys, and the tension that pervaded the atmosphere, though it did not relax, changed suddenly from one of intense anger and suppressed excitement to one of consternation and wonderment. The gasp and the sudden reversal were due to the fact that both teacher and pupils suddenly became aware of the fact that the outburst had been witnessed by the principal of the school and several lady visitors.

Probably the thoughts of self-condemnation that raced through that teacher's mind as the door closed after the visitors were more poignant than were the words of the principal during the uncomfortable half-hour interview that terminated that school day for the teacher? Who knows? No doubt that teacher never forgot the occurrence, and no doubt he profited by it.

This story of something that actually occurred may have a humorous angle but it also has a decidedly serious side. Overlooking that the teacher had allowed his temper to run away with his better judgment, that the principal had been placed in a very disadvantageous position before his visitors, that the callers may have obtained a very erroneous conception of the methods used in teaching the students in that school — what about the effect of the outbreak on the pupils?

One of the main duties of the teacher is to set the proper standard for his pupils. The student is the crude plastic clay out of which the master craftsmen — and that is what every teacher ought to be — must fashion the future citizen. Not only must the teacher set standards of workmanship, but he must also establish standards of honesty, justice, fair play, tolerance, and poise. Will the students acquire such standards if their teachers are not careful about maintaining them? No doubt the pupils had heard worse bursts of profanity than the teacher made use of. Probably they may even use such language themselves, but the sanction given to this improper use of language by the teacher's action may be just what was needed to break down the inhibition to the use of such language which some good mother by great care had built up in her boy. Whether the teacher admits it or not, if he wants to be a real teacher, he is forced to maintain high standards for himself at all times.

Teachers, like the ministers of the gospel, must ever be on the alert to make their lives and their teaching coincide. There cannot be one set of standards for the teacher's life within the classroom and another for his life outside.

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## NOR THE LAST TO LAY THE OLD ASIDE

Years ago, before the day of our present gigantic locomotives, the water was forced into locomotive boilers by small mechanically operated pumps that obtained their motion from the connecting rod. This meant that when a locomotive was standing still, no water could be pumped into its boiler, because the connecting rod of a standing locomotive is not in motion either.

At that time it was frequently necessary, if the train was to stand on a siding for some time or if an exceptionally steep or long ascent which would require an unusual amount of steam had to be made, to uncouple the locomotive and to run it rapidly back and forth over a short stretch of track in order to pump an extra large amount of water into the boiler.

Then came the day when the first injector was put on the locomotive boiler. This device was chosen because as long as steam is available, the injector can be used to force the feed into the boiler, and it matters not whether the engine is in motion or not. The engineers who were accustomed to the old feed-water pumps were highly distrustful of the new device. They knew how to handle the pump, but they were not so sure that they could operate, or learn to operate the injector which to them appeared rather mysterious. As a result they did everything they could to discredit the new piece of apparatus in the hope of not being forced to ignominously confess that they did not know, and could not learn how to manipulate it.

However, in the long run, the injector won out, and no present-day engineer under any circumstance, would want to exchange the efficient injector for the old-type locomotive boiler pump.

An analogous thing is happening in the school field at present. Some of the shop teachers who were not fortunate enough to have studied about the present-day tests and measurements when they were obtaining their teacher-training look with a great deal of distrust at those who want to displace the old-time, essay-type examination, the questions for which can be hurriedly prepared, and the grading of which is not hard even though it is time-consuming, with the new objective-type examinations. Nothing is gained by trying to discredit the new movement. Either it is good or it is bad, but whether it is the one or the other, depends not up-

on individual opinions, but upon the comparison between the results obtainable by the two methods.

Prejudice does not solve problems. A fair trial, however, will readily show the advantages of the new over the old method. It may be found that the new-type examination questions do contain defects. If so, it may be well to help eradicate them. At any rate, this modern method is gathering new adherents continually. It is well, therefore, to learn as much about it as possible. If the method is good, a careful study of it will help the teacher to master its intricacies; if it is no good the study will help to disclose its defects.

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## A WORTHY EXAMPLE

On March 3, 1931, was the centennial of the birth of George Mortimer Pullman, and celebrations in honor of this event are scheduled or have already been held in various parts of the country. Such recognition presages that Mr. Pullman must at one time or another have done great things.

A study of his life shows that in the 66 years of his life he crowded much that was worth while. Starting as a poor boy with little schooling, he forged forward by his own exertion. His inventive genius, foresight, and ability to work hard, all stood him in good stead. He needed these characteristics to accomplish the many things that were accepted at his time as belonging to those problems that are impossible of solution. Thus, his raising of the Tremont House, at Chicago, a large six-story brick and stone building, without damaging the building nor interrupting the business that was carried on within it, gave him instant recognition in engineering circles throughout the country.

He is best known, however, for the improvements which he affected in the comfortless sleeping accommodations which the railroads offered prior to 1860.

His ingenuity not only provided better sleeping accommodations for travelers, but he also produced the first dining cars,the first gas-lighted cars, the first cars illuminated by electricity, the first vestibule cars, and the first steel cars.

All of his later endeavors seem to have been directed toward the end that his fellow men could more comfortably and more safely travel. But he was not only concerned with profit-bearing inventions. He looked upon his employees as men intrusted to his care. As early as 1879, at a time when labor was still generally looked upon more or less as a chattel, Mr. Pullman conceived and built an industrial city which astounded the industrial world.

This same spirit prompted him to make a bequest of $1,200,000 with which to found and endow the Pullman Free School of Manual Training for the children of the workers in the Pullman factories, and those of the people living in Pullman. This school, imbued with the spirit of its founder, has done and is still doing most excellent work. Its faculty, fulfilling the last wishes of the founder, is giving the youth of Pullman a real opportunity to prepare for a trade.

What a wonderful inspiration and example for all is the life of a man like Mr. Pullman. First of all, is the conscientious use of the talents with which providence provided him. Too poor to receive an extended education he made the best of his opportunities and let hard work and close attention to duties make up the deficiency.

Secondly, having developed a business that required many employees, he made their welfare his own concern.

Thirdly, not having had the opportunity of getting much education himself, but knowing its value, he made it freely available to others.

What a fine example to hold up before the students in the vocational schools among whom the future Pullmans are now being trained!

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## DON'T VERSUS DO

Frequently the assertion is made that all instruction should be made positive. In other words, that the teacher should tell the student what to do, rather than what not to do.

Psychologically this is good advice, and should be adhered to in most cases. The rule itself merely means that it is better to put the suggestion of the wanted reaction into the student's mind, rather than suggest something to which he must react negatively in order to secure the desired reaction. Thus, the mother's advice to her three young children as she left home, not to put any beans in their noses, resulted in a job for the doctor. Each one of the three young hopefuls had tried something which the mother had not intended but which her remark had suggested. Under ordinary conditions these children would most likely not have thought of putting beans into their noses, but the mother's words got their little minds busy until they did what they had been told not to do.

With older children, however, it may be even beneficial at times in giving a negative suggestion and then have this turned into a positive rule as a result of a discussion by the students themselves.

In other words, the negative statement will merely be looked upon as a problem for which the student must adduce proofs to establish its correctness.

Some form of this negative training is really necessary, because when the student leaves school, he will frequently be confronted with problems in which he must recognize what is wrong and then correct the error. If such situations arise in real life, the school must recognize the fact and train its students to meet conditions as they are.

This means then, that it is permissible at times, to ignore the dictum of the psychologists, and to show by words or pictures what not to do in order that the student himself has an opportunity to reason out why such a rule becomes necessary.

This method then becomes another opportunity for the student to exercise his reasoning faculties, in other words, to think before doing.

# New-Type Tests in Auto Mechanics

*Stephen Henry Hurtuk**

As teaching aids, tests and examinations have been used as a regular part of schoolwork for hundreds of years. Recently, however, a great deal of comment and criticism has arisen concerning the form and function of tests and examinations. Some educators advocate that they be abolished altogether, while others urge decided changes in their form and use. There are arguments both for and against each position; however, it seems that the remedy is not to do away with tests, but to concern ourselves with learning how to make better ones which will fit in with the generally recognized objectives of education. If tests are properly constructed and administered, most of the adverse criticism which is now made against them will no longer apply.

Some teachers prefer standardized tests, while others prefer to construct their own. Standardized tests are in some ways superior to those made by the teacher, while, on the other hand, teacher-made tests have a number of points in their favor. The chief advantage of standardized tests is that they give the teacher a fairly accurate comparison of the pupils' achievements with those of large groups of pupils of the same grade, age, etc., by establishing a norm, or a statement of the average achievement of the group. The chief advantage of teacher-made tests over standardized tests is that they can be adapted to local courses of study, to the points of emphasis of the individual teacher, and to the need of the particular class or individual.

In many instances it is reasonably easy for an able teacher to make his own tests similar in form and content to that of the standardized tests. If these new-type tests are to serve their purpose they must measure a great many things, such as the ability and accomplishment of the pupil, diagnosis of the pupil's work, improvement of the teacher's efficiency, motivation, and establishment of standards. They should be objective, and should be easy to give, easy to score, and easy for pupils to take. The questions and directions should be simple, definite, and clear, reducing guessing to a minimum. The tests themselves may be of a variety of types. Corrected papers should be returned promptly and discussed with the pupils, and should contain marks which will show him plainly all his mistakes. Telling pupils their standing with regard to the class as a whole often has a good effect.

Timing of these short tests should be fairly exact. It is satisfactory to give warning when about 10 per cent of the time remains so pupils may complete answers as best they can in the remaining time.

These new-type tests are more reliable than the old form of essay examination. They can be so constructed as to leave no doubt as to whether the answer is right or wrong. They afford opportunity for the pupil to respond to a wide variety of questions in a much shorter space of time. They touch briefly the main points emphasized and do not waste time. They have a tendency to make the pupil much more satisfied with his mark because the answer is very obviously either right or wrong. Where the emphasis is placed upon exact and accurate knowledge as it is in these tests, the pupil soon learns that his answers are very little affected by his poor English or handwriting, and other abilities which so often play a large part in an essay type of test.

Yet another advantage of these new-type tests is that they are easy to score. Some teachers avoid the extra work of marking the old-type examination paper by reducing the number of tests given. This is eliminated by the new-type test. Some person unfamiliar with the subject matter, can, with the aid of a key, score most new-type examinations satisfactorily. It is frequently possible to have pupils mark their own papers or those of other pupils.

The greatest difficulty met with by the industrial-arts or vocational teacher who contemplates a testing program, is that satisfactory tests do not yet exist in many of his subjects. The tendency to construct standardized tests seems to be growing, but so far the majority of these tests are concerned chiefly with academic subjects. There is now a crying need for satisfactory tests in almost every subject which the industrial-arts or vocational teacher handles.

The following tests are submitted as samples of the various types which it is possible to utilize to great advantage. By frequently using short tests the accomplishment and diagnosis of the pupil as well as the improvement and measurement of teaching efficiency can be quickly checked with large groups by a minimum expenditure of the teacher's time.

It might be well to explain here that these tests may be hectographed or mimeographed in order quickly to get enough copies for the group of students to be tested. The teacher will find that the time it requires to construct and duplicate these tests, and the time it requires to score them, is a very small amount in comparison with the time required to do the same for the old-type essay form of test or examination.

The writer has found that a great many short tests given at irregular intervals is far better than a few very long ones at regular periods. These tests may take a variety of forms, but the examples here given are those which have been found to produce the best measuring results. One example has been chosen from each of the following types: Single-answer test; multiple-

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or best-answer test; true-false or alternative test; completion test; matching test; and identification test.

### The Single-Answer Test

Each exercise of this type of test, which is the easiest to construct, consists of a direct question, to which there can be only one possible correct answer. This type can be easily adapted to almost any subject or part of a subject. Here there is little chance of guessing the correct answer as no help is given by offering several possible answers.

*Sample Single-Answer Test*

Name..... Period.....

*Directions:* Read each question below and then on the blank line in front of it write the correct answer. No answer requires more than two words.

——— 1. What type of steering gear is the cam and lever?
——— 2. How many times does the camshaft rotate in two revolutions of the crankshaft gear?
——— 3. What kind of valve arrangement has the Buick car?
——— 4. What type of axle is used on the Model A Ford?
——— 5. What is the average setting for breaker points?
——— 6. How many main bearings does the average 6-cylinder engine have on the crankshaft?
——— 7. How many bearings are required in each wheel of a full-floating type of rear axle?
——— 8. What apparatus is provided to engage and disengage the power of the engine?
——— 9. With what are pistons fastened to connecting rods?
——— 10. What does the ring gear drive?
——— 11. What is the most popular type of transmission?
——— 12. With what is the automatic engagement and release of starting gear accomplished in the average car?
——— 13. What is used to seal the clearance between the piston and cylinder wall?
——— 14. What type of thread is used for fine adjustment on auto engines?
——— 15. What cooling medium is used on a Franklin car?
——— 16. What width gap at the spark plug will give good results under ordinary conditions?
——— 17. How many sparks would an 8-cylinder 4-cycle engine require for each revolution of the crankshaft?
——— 18. What is used to stop arcing at the interrupter contacts?
——— 19. Of what are piston rings made?
——— 20. How are exhaust gases silenced?

### Multiple- or Best-Answer Test

The outstanding feature of this test is that it suggests several answers to each question and requires the pupil to choose one of these answers correct or best. It is common to include only one correct answer in the group suggested, requiring the pupil to mark the correct one. This type of test has been criticized, claims being made that suggesting wrong answers confuse pupils, but this danger is slight if pupils are familiar with the subject matter covered.

*Sample Multiple- or Best-Answer Test*

Name..... Period.....

*Directions:* In each exercise below you will find three possible selections inclosed within parentheses. Only one of these is correct. Draw a line under the one which you think is correct.

1. The screw-and-half-nut type of steering gear is (semi-irreversible) (irreversible) (reversible).
2. The operation of all types of engines is based on the fact that when gas is heated it (contracts) (expands) (condenses).
3. The differences in the rate of rotation of the rear wheels in turning corners is taken care of by the (transmission gears) (side gears) (differential).
4. Most spark plugs use a gap setting of (0.015) (0.025) (0.035).
5. The Model A Ford car has a (plain live) (semifloating) (three-quarter floating) type of rear axle.
6. Change in the ratio between the speed of the engine and the speed of the rear wheels is provided for by the (timing gear) (differential gear) (transmission gear).
7. The Model A Ford car is equipped with a (planetary) (cam and lever) (worm and sector) type of steering gear.
8. The condition in which the wheels are closer together at the point of road contact than at the top is called (toe-in) (camber) (caster).
9. The length of stroke of an engine is (2) (1½) (3) times the length of the crank.
10. When the interrupter contact points are burned or pitted they should be dressed down with a (file) (emery cloth) (oilstone).
11. The reciprocating motion of the piston is converted into a rotary motion by the (camshaft) (drive shaft) (crankshaft).
12. The most common method of cooling the automobile engine is by (pump-water circulation) (forced feed) (thermo-syphon) system.
13. The metal employed for making crankshaft and connecting-rod bearings is almost invariably (babbitt) (bronze) (aluminum).
14. The Borg and Beck is an example of the (plate) (multiple disk) (cone) clutch.
15. The hydraulic brake uses a fluid mixture of (water and alcohol) (alcohol and castor oil) (glycerine).
16. The mechanical stoker which mixes air with gasoline and delivers it to the cylinders is called a (fuel pump) (vacuum tank) (carburetor).
17. The fuel is admitted to the cylinder in a 4-cycle engine by means of valves operated by a (crankshaft) (eccentric shaft) (camshaft).
18. A 6-cylinder engine requires (3) (6) (12) sparks for each revolution of the crankshaft.
19. Clean oil is an (insulator) (conductor) (semiconductor) of electricity.
20. When a series of operations are completed in one revolution of the crankshaft it is termed a (4-stroke cycle) (2-stroke cycle) (sleeve-valve) engine.

### True-False or Alternative Test

This test requires the pupil to choose between two possibilities in answering the questions. This type gives greater opportunity for guessing the correct answer. For this reason it is not one of the best types and should not receive so much use as some of the other types, but its use should not be altogether discontinued.

*Sample True-False or Alternative Test*

Name..... Period.....

*Directions:* Below are 20 statements, about half of which are true and the remainder, false. If you think the statement is true, draw a circle around the letter T. If you think the statement is false, draw a circle around the letter F.

T F 1. The Hotchkiss drive is a type of spring suspension having no radius rod, torque tube, or torque arm.
T F 2. Radius rods are sometimes used to keep the axle in alignment.
T F 3. The reversed Elliott type of axle is used on the Ford Model A.

T F 4. Caster is the name applied to the condition in which the wheels are closer together at the point of road contact than at the top.
T F 5. The chief advantage of the cam and lever type of steering mechanism is that it is semi-irreversible.
T F 6. In the full-floating type of axle the inner end is the floated end and is subject to all strains except torque.
T F 7. Low gear is direct drive through the transmission.
T F 8. The piston receives the force of the expanding gases.
T F 9. During two revolutions of a 6-cylinder 4-cycle engine, nine power strokes are developed.
T F 10. There are six types of cylinder heads designated by letters.
T F 11. In the I-head engine two camshafts are required.
T F 12. The wrist pin which connects the piston to the connecting rod always is made solid.
T F 13. Lack of power is sometimes due to dragging brakes.
T F 14. Hard steering may result from lack of lubrication.
T F 15. The S.A.E. thread is used extensively in auto engines.
T F 16. The camshaft controls the opening and closing of the valves.
T F 17. The 4-stroke-cycle engine carries on operations above and below the piston.
T F 18. The Cord automobile has a front-wheel drive.
T F 19. The valve arrangement of a Ford is termed *T-head.*
T F 20. The function of the carburetor is to supply raw gasoline to the intake manifold.

## Completion Test

The completion test consists of statements with one or more of the important words left out, these words to be supplied by pupils. There is very little chance for guessing the correct answer in this type. The many good points of this type test recommend its wide use.

*Sample Completion Test*

Name..... Period.....

*Directions:* Below are 20 sentences in each of which one or more words or numbers have been omitted, and blanks inserted where the word or number should be. Write on each blank the correct word or number, but do not in any case write more than one word on each blank.

1. Unlike poles will attract and ——— poles will repel each other.
2. The ——— winding of the coil receives the battery current.
3. Arcing at the interrupter contacts is eliminated by the use of a ———.
4. The ballast resistance coil is connected in ——— with the primary circuit.
5. The burning out of many bulbs is an indication of ——— in the charging circuit.
6. Bulb filaments are made of ———, contact points in battery ignition systems are made of ———, and contact points in magnetos are made of ———.
7. A spark plug must ——— the spark into the cylinder and prevent leakage of ——— and explosion pressures.
8. A storage battery stores ——— energy.
9. A grid is made of ——— and ———.
10. The specific gravity of the electrolyte in a fully charged battery should be ———.
11. Heating of a battery causes the ——— to evaporate.
12. The third brush should be moved ——— the direction of rotation to increase the charging rate.
13. A ——— magnet retains its magnetism for a long period of time.
14. A third-brush generator is made of ———.
15. The spark current is induced in the secondary when the ——— points open.
16. The ——— is the unit of measurement of resistance of a conductor to the flow of an electrical current.
17. The compass depends upon the ——— of the earth for its action.
18. The ——— points in a battery ignition system are shunted by a ———.
19. The fine wire of a coil is known as the ——— windings.
20. The ammeter indicates the amount of ——— flowing in the circuit.

## Matching Test

A matching test represents two sets of items or expressions, requiring pupils to match those of one set with those in the other. This type may be easily prepared to cover almost any phase of a subject. The test may be improved by including a number of items in one list which do not match any of those given in the other. This type of test should be used frequently as it possesses many good points.

*Sample Matching Test*

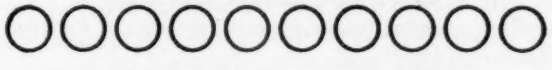
Name..... Period.....

*Directions:* Each of the 50 phrases listed below is explanatory of, or closely connected with, some one of the seven headings under "Troubles." Indicate the proper connection by writing the number of the phrase with which each term is connected in the circle. No term in the column below should be used more than once. Check each term as used to avoid using it again.

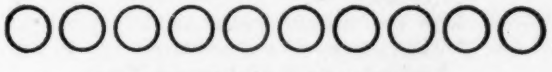
*Sample:* Item 11, distributor cap, belongs under "Ignition troubles," as shown.

A. Engine Troubles — Ignition System

B. Engine Troubles — Fuel System

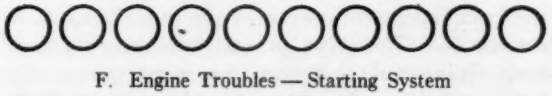


C. Engine Troubles — Loss of Compression



D. Engine Troubles — Cooling System

E. Engine Troubles — Lubricating System



F. Engine Troubles — Starting System

G. Chassis Troubles

1. Radiator empty
2. Squeaks
3. Roller clutch
4. Bendix drive
5. Ignition switch
6. Valve stems

7. Vacuum tank
8. Ignition coil
9. Piston rings
10. Air vent
11. Distributor cap
12. Hard steering
13. Starter pinion
14. Fan belt slipping
15. Lack of oil
16. Water pump broken
17. Clutch engages abruptly
18. Pump spring broken
19. Spark plugs
20. Carburetor
21. Valve spring weak
22. Carburetor floods
23. Breaker arm and points
24. Cylinder-head gasket
25. Fuel pipe
26. Broken springs
27. Valve lifters
28. Carburetor choke shut
29. Starting motor
30. Dragging brakes
31. Vacuum-tank float
32. Starting switch
33. Suction pipe
34. Hose connections
35. Water in crankcase
36. Carburetor adjustment
37. Low pressure
38. Rapid tire wear
39. Muffler
40. Ground connection
41. Abnormal pressure
42. Spark lever retarded
43. Pump not primed
44. Rattles
45. Starting switch connection
46. Battery connections loose
47. Battery run down
48. Radiator clogged
49. Valves
50. Strainers

### Identification Test

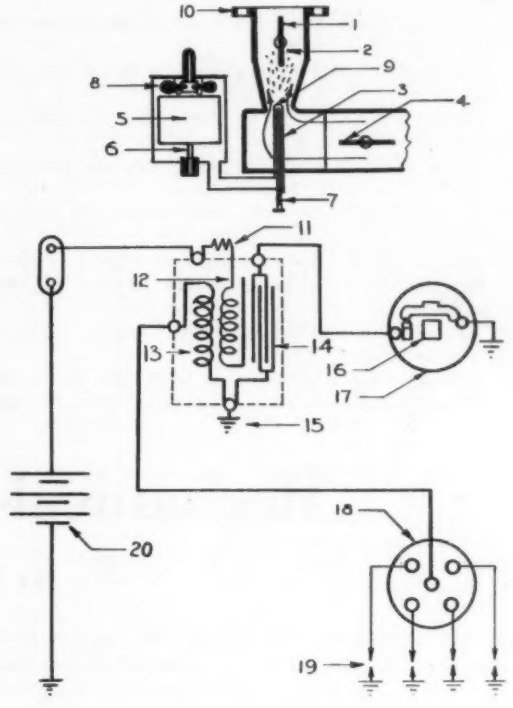
An identification test consists of a picture or figure, different parts of which are in some way to be identified. There are many facts in industrial-arts and vocational subjects which may be very satisfactorily tested with this type of test; in fact, it is sometimes rather difficult to test certain knowledge without the use of a drawing. This type is the most difficult to prepare, as drawings are not so easy to make and duplicate as written material. This type is very easy to score as it is absolutely objective.

*Sample of Identification Test*

Name..... Period.....

*Directions:* Below will be found two drawings, one of which represents a carburetor and the other an ignition system. Referring to these drawings, identify the numbered parts and insert the name of the part on the blank line bearing the same number.

1. ..... 11. .....
2. ..... 12. .....
3. ..... 13. .....
4. ..... 14. .....
5. ..... 15. .....
6. ..... 16. .....
7. ..... 17. .....
8. ..... 18. .....
9. ..... 19. .....
10. ..... 20. .....




# Electrical Test

*H. J. Johnson**

THE following is Section I of an electrical test consisting of 200 test questions.

Sheet 1. Section 1

Name..... Class.....

Fill in the blank spaces with words that will complete the sentences, a blank line being provided for each word.

1. The Voltaic cell consisted of one ——— electrode and one ——— electrode.
2. A Voltaic cell develops an e.m.f. of about ——— ———.
3. Static electricity is produced by ———.
4. All cells produce current by ——— ———.
5. A glass rod rubbed with silk develops a ——— charge of static electricity.
6. A vulcanite rod rubbed with fur develops a ——— charge of static electricity.
7. Two static charges of like kind ——— each other.
8. Two static charges of unlike kind ——— each other.
9. A neutral body is ——— by either charge.
10. When a number of cells are connected in ——— the combined voltage is the sum of all.
11. When a number of cells are connected in ——— the combined voltage is that of a single cell.
12. A good, standard-sized dry cell should deliver between ——— and ——— amperes when new.
13. The size of a cell does not affect its ———.
14. Electromotive force or voltage is measured in ———.
15. Current strength is measured in ———.
16. Resistance is measured in ———.
17. Current flows only in a ——— circuit.
18. Connecting the positive and negative wires without suitable resistance causes a ——— ———.
19. Circuits are protected from dangerous currents due to overloads or short circuits by ———.
20. Blown fuses should be replaced by ——— ——— of the ——— ———.
21. Circuit breakers operate by ———.
22. When the earth is used as one conductor, the circuit is said to be ———.
23. In a three-wire system, the ——— or ——— wire

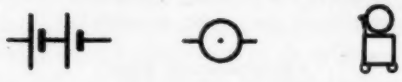
*Duluth, Minnesota.

is generally grounded.

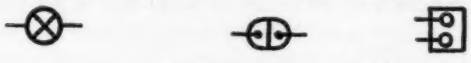
24. The plates of a cell are called the ———.
25. The solution in a cell is called the ———.
26. Local action is largely prevented in dry cells by ———.
27. When a cell is short circuited for some time, the carbon electrode becomes ———
28. Several cells connected together form a ———.
29. In a series circuit, all the members receive the same amount of ———.
30. In a parallel circuit, all members receive the same ———.
31. Removing one lamp from a ——— circuit puts out all.
32. Removing one member of a ——— circuit does not affect the others in any way.
33. Adding more members to a ——— circuit decreases the resistance.
34. Adding more members to a ——— increases the amount of current being used.
35. In the ordinary house lighting circuit, the lamps are connected in ——— with each other.
36. In a doorbell circuit, the push button and bell are connected in ———.
37. Several cells for a bell circuit are connected in ———.
38. If a number of buttons are to ring the same bell, they must be connected in ——— with each other.
39. To control a hall light from two places, ——— switches must be used.
40. To control a hall or stair light from three places, two ——— switches and one ——— switch must be used.
41. The switch most commonly used of all switches in house lighting circuits is the ——— switch.
42. Electrical conductors are commonly made of ———.
43. Aluminum has a ——— resistance than copper.
44. A high-resistance conductor commonly used for the element of heating device is called ———.
45. Wood is a fairly good insulator if it is ———.
46. A person is most likely to receive a shock from a live wire of he is ———.
47. Diagram a series connection of these five cells:

48. Diagram a parallel connection of these five cells:

49. Diagram connections for a simple bell circuit:



50. Diagram connections for a simple lighting circuit:



(To be continued)

# Mechanical-Drawing Test

*W. G. Hjertstedt**

*General Directions:* The aim of this examination is to give you an opportunity to show what you have learned from your study of mechanical drawing. It is not expected that you will be able to answer every question. Read the directions and every statement carefully and be sure you understand what you are to do before you begin.

Name..... Room.....

Course..... Date.....

*Specific Directions:* The following questions can be answered by a single word, phrase, or number. Complete statement by writing missing word, phrase, or number in each blank. Your score for this part will be based on the number of blank spaces correctly filled. No penalty will be exacted for blank spaces incorrectly filled.

1. ALT is the abbreviation for ———.
2. Hidden edges are shown by ——— lines.
3. The meaning of the letters SV in projection drawing is ———.
4. An angle of 90 degrees is called a ——— angle.
5. The letter R is the abbreviation for ———.
6. Isometric drawings have ——— and ——— lines.
7. The shape of an isometric circle is ———.
8. Projection lines are represented by ——— lines.
9. When inking a drawing draw ——— first.
10. The meaning of the letter H in projection drawing is ———.
11. From a tracing you can make ——— blue prints.
12. The hour hand of a clock is ——— at six.
13. An axis line or the trace of a plane is represented by ——— line.
14. When the hands of a clock are at twelve and three respectively they form a ——— angle.
15. A hexagonal bolt has ——— sides.
16. The meaning of the letter V in projection drawing is ———.
17. A one-half scale drawing is ——— than the object represented.
18. Drawings of objects as they naturally appear to the eye are called ———.
19. Center lines are shown by ———.
20. In one and one-half inches there are ——— thirty-seconds.
21. DIA is the abbreviation for ———.
22. The distance from the center to the circumference of a circle is called the ———.
23. Visible edges are shown by ——— lines.
24. The hour hand of a clock is ——— at nine.
25. The sum of all of the angles in a triangle is ——— degrees.
26. The border line is represented by a ——— line.
27. Projection lines are represented by ——— lines.

**Key**

| | | |
|---|---|---|
| 1. altitude | 10. horizontal plane | 19. one dot and one dash |
| 2. dotted | 11. many | 20. forty-eight |
| 3. side vertical plane | 12. vertical | 21. diameter |
| 4. right | 13. a dash and two dot | 22. radius |
| 5. radius | 14. right | 23. full |
| 6. vertical; oblique | 15. six | 24. horizontal |
| 7. elliptical | 16. vertical plane | 25. 180 |
| 8. full | 17. smaller | 26. full |
| 9. curves | 18. perspective | 27. full |

*Roosevelt High School, Chicago, Ill.

# Architectural-Drawing Test

*W. G. Hjertstedt**

Arrangement or Matching Exercises
(Matching terms in parallel columns)

*Directions:* Each of the questions below consists of a list of items. Arrange these in their proper order. Do this by writing the figure (1) before the item that should come first, (2) before the one that should come second, (3) before the one that belongs next, and so on to the last.

*Example:*

| | |
|---|---|
| 5. Colonnade | 1. A section of a building extending out from the main part. |
| 1. Wing | 2. The band of small moldings at the bottom of the Echinus of the Greek Doric capital. |
| 4. Cyma | 3. The slope of the face of a wall that is not plumb. |
| 2. Annulets | 4. One form of molding. |
| 3. Batter | 5. A continuous series of columns. |

| | |
|---|---|
| ——Tracery | 1. A structural-steel shape. |
| ——Abacus | 2. Painting on fresh plaster before it has dried. Commonly, though incorrectly, used for any painting on plaster. |
| ——Hip Roof | 3. The center top stone of an arch. |
| ——Ogee | 4. Ornamental curving bars across an opening. They usually occur in Gothic buildings and are cut from stone. |
| ——Fresco | 5. The topmost division of the capital of a column. |
| ——Loggia | 6. A roof sloping up from all walls of the building. |
| ——Channel | 7. An accepted division for measuring proportions of the Orders of Architecture. It is taken as one half of the base diameter of the column. |
| ——Quoins | 8. A division wall common to two adjacent pieces of property. |
| ——Valley | 9. A platform projecting from the building wall. |
| ——Module | 10. A reverse, or letter S, curve. |
| ——Sleepers | 11. The gutter formed by the intersection of two roof slopes. |
| ——Balcony | 12. The top member of a wall, pier, etc., from which springs an arch. It may be the capital of a pier or just a molding on a wall. |
| ——Keystone | 13. The main or central portion of a church auditorium. |
| ——Extrados | 14. The framing timbers which are the direct support of a floor. |
| ——Nave | 15. The name applied to the upper or outside curving line of an arch. |
| ——Girder | 16. A hall within a building but open on one side, this side being usually supported by a colonnade. |
| ——Party Wall | 17. A large horizontal structural member, usually heavier than a beam and used to support the ends of joists and beams, or to carry walls over openings. |
| ——Impost | 18. The timbers laid on a firm foundation to carry and secure the superstruction. |
| ——Joist | 19. Large cut stones at the corners of a masonry wall. They form an ornamental corner and also a stoppage for the stone or brickwork of the wall proper. |

*Answers:*

1. Channel
2. Fresco
3. Keystone
4. Tracery
5. Abacus
6. Hip Roof
7. Module
8. Party Wall
9. Balcony
10. Ogee
11. Valley
12. Impost
13. Nave
14. Joist
15. Extrados
16. Loggia
17. Girder
18. Sleeper
19. Quoins

*Roosevelt High School, Chicago, Ill.

WORK SHOWN AT THE AMSTERDAM INDUSTRIAL SCHOOL EXHIBIT
Photo by J. Van Dijk, Netherlands

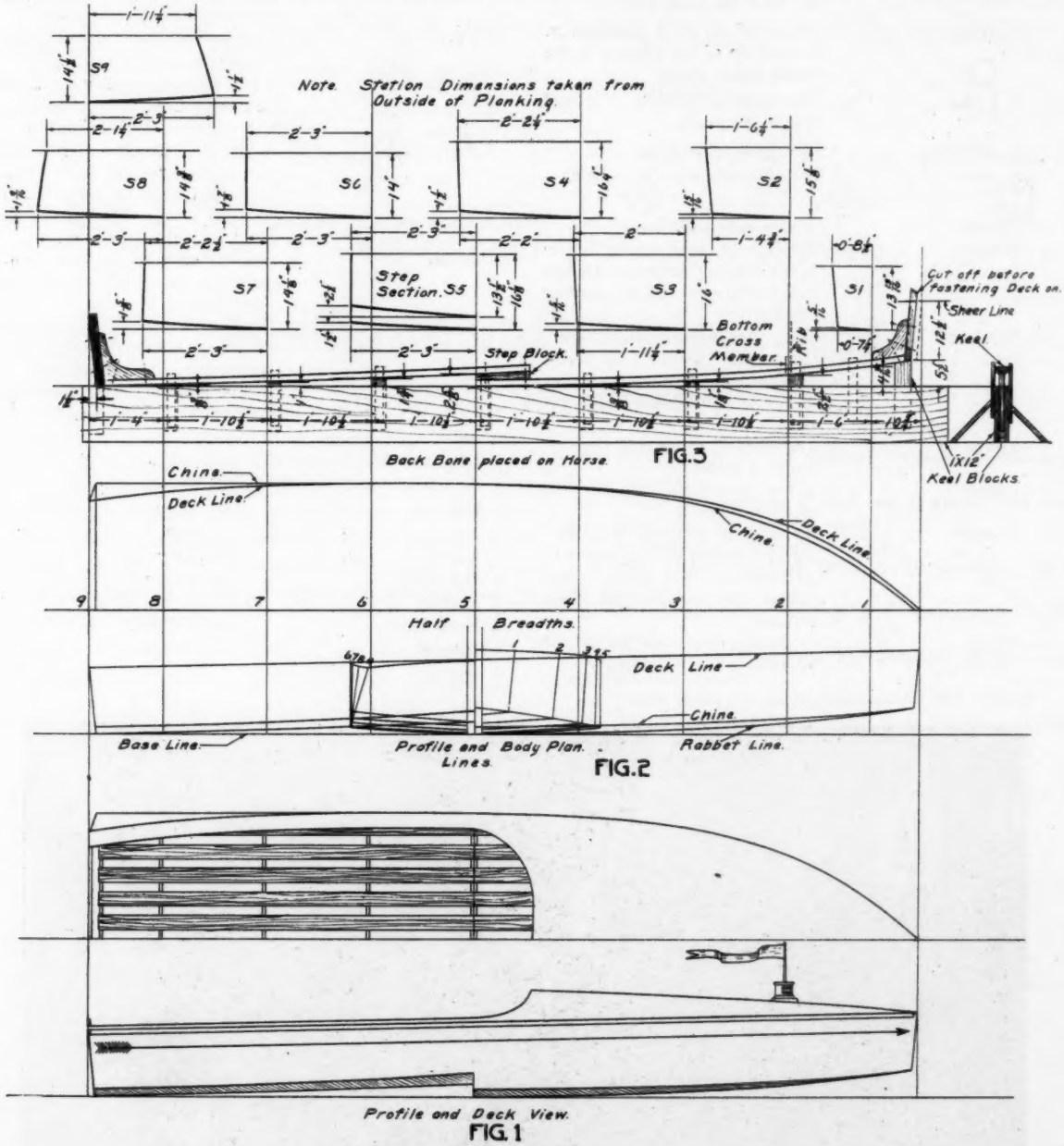
# PROBLEMS AND PROJECTS

## AN OUTBOARD SPEEDSTER

**Claude William Horst, Milwaukee Vocational School, Milwaukee, Wisconsin**

The boat described herewith is inexpensive, easy to build, and very fast. The lines have already been reproduced full size and the measurements corrected, so they may be used just as they are without being laid down again. Study the plans carefully before starting the job. The various steps in the procedure are taken up in the order in which they should be executed.

The first thing to be made is the backbone, which consists of the forward keel, the aft keel, the inner stem, the knee

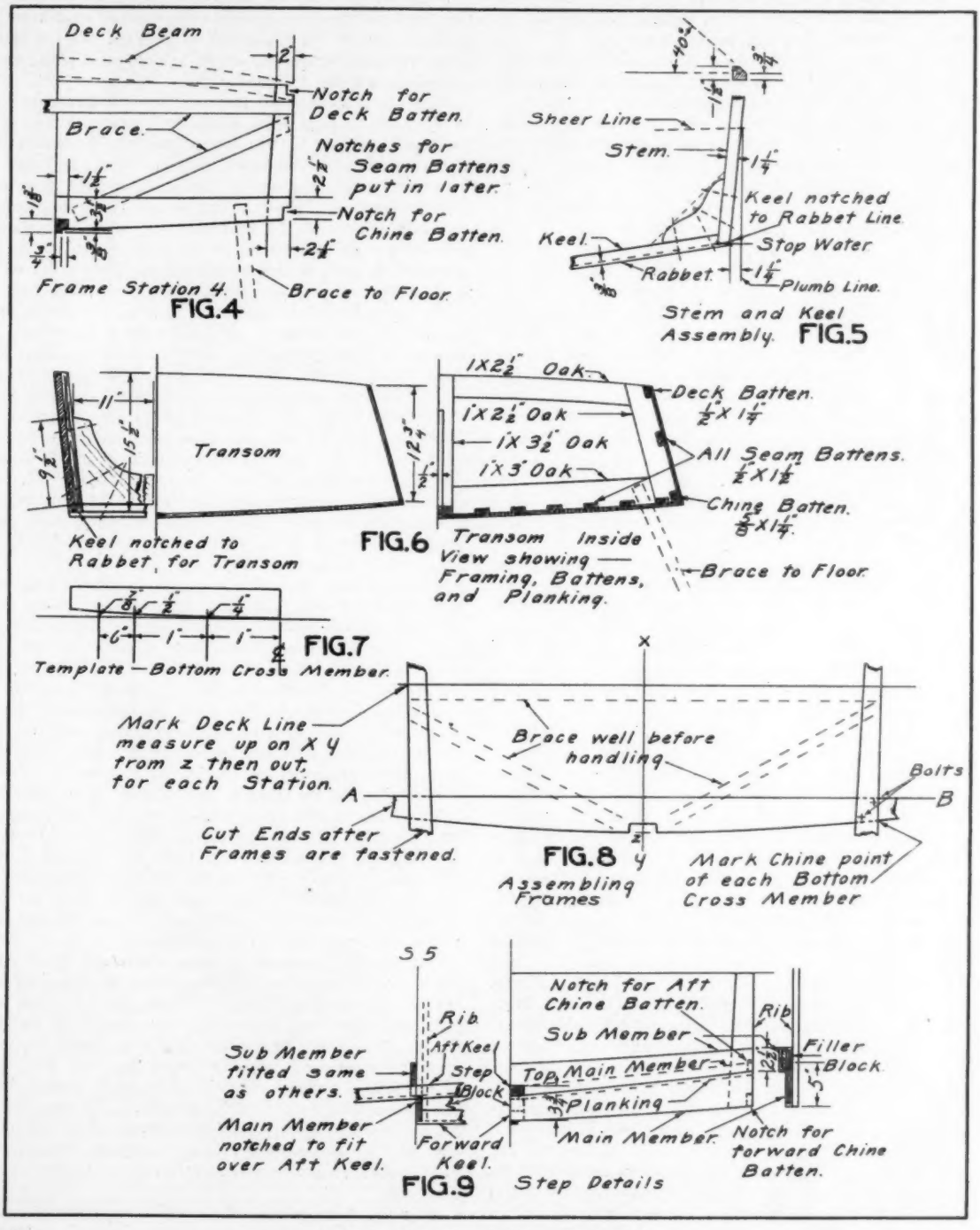



DETAILS OF OUTBOARD SPEEDSTER

and the step block (Fig. 3). It is made of oak, or some other hard wood. The following material will be needed for the backbone:

| | | |
|---|---|---|
| Forward keel | 1⅜ | by 3 in. by 8 ft. 4 in. |
| Aft keel | 1⅜ | by 3 in. by 7 ft. 4 in. |
| Inner stem | 1¼ | by 3 by 16 in. |
| Knee | 1 | by 6 by 12 in. |
| Step block | 2 | by 3 by 12 in. |

The keel pieces are rabbeted for planking, as shown in Figure 4. It is then necessary to build a horse, such as the one shown in Figure 3, which is made of two pieces of lumber, 1 by 12 in. by 16 ft., and some short pieces, 1 by 3 in. Plane off the top edge of each plank. As this is taken as the base line for a number of measurements, it must be true. Mark off the stations from 1 to 9 on one of the planks, as shown in Figure 3. For each station cut a piece, 1 by 3 by 12 in. Number these pieces from 1 to 9, and on No. 1 measure off 4 3/16 in., on No. 2, 2½ in., and so on for all nine using the dimensions given in Figure 3. Nail these pieces to the marked plank with the back edge on the station line and the amount just measured off extending above, as shown. The piece forward must be carefully fitted so that the front end of the keel will be raised 5½ in. above the top of the horse. Nail the two planks together with the short pieces in place be-




DETAILS OF OUTBOARD SPEEDSTER

tween them. Brace the horse well and mount the keel on the pieces, as shown. Bend the keel to the pieces and fasten it down with side straps, as shown in the end view, Figure 3. Fit the step block very carefully and fasten the structure together with two ¼-in. bolts. Shape the knee and the stem, and notch the forward keel according to Figure 5. The stem should project about 4 in. above the sheer line to provide for bracing. Bolt together with four ¼-in. bolts. True up the whole structure by suspending a plumb bob from the center of the stem at the sheer line, as shown in Figure 5. This point should be 1¼ in. farther forward than the bottom of the keel. The stem should be exactly perpendicular when viewed from a fore or an aft position. After it has been trued up, the stem should be well braced, especially at the top, to prevent any shifting when the planking is put on.

A stopwater to prevent leaking at the stem is very important. Drill a ⅜-in. hole all the way through, as shown, and plug it with a well-fitted softwood plug.

The transom also is entirely of oak, or other hard wood, and is made next. The height required for the particular motor to be used should be obtained from the agent of whom the motor is purchased. Material needed:

| | |
|---|---|
| Planking ..... | ¾ by 16 in. by 4 ft. 6 in. |
| Center piece ..... | ¾ by 6 by 14 in. |
| Knee ..... | 1¼ by 3 by 16 in. |
| Bottom member ..... | ¾ by 4 in. by 4 ft. 6 in. |
| Frames, 2 pieces..... | ¾ by 3 by 16 in. |

Cut the transom planking, which should be all in one piece, according to the dimensions at station 9, Figures 3 and 6. Work from a center line in laying out the piece. Cut notches for battens in the frame pieces and in the bottom members, as shown in Figure 6. Then assemble the pieces using 1½-in. flat-head, No. 10 wood screws as fastenings. Notch the aft keel and shape the transom knee as shown. Bolt the knee to the keel with two 5/16-in. bolts. Put the transom in place, test it with a level on top to get it horizontal, brace it well, and then bolt it to the transom knee with 5/16-in. bolts, countersinking their heads into the transom about ⅜ in. and plugging the holes.

The frames for all the stations from 1 to 8 may now be made, using the dimensions given in Figure 3. The ribs must be beveled according to the angle of the chine and the deck at that particular station. All the ribs forward of the step are placed forward of the station line, and the bottom cross members just aft of the station line (Fig. 3, Sta. 2). All the ribs aft of the step are placed aft of the station line, and the bottom cross members forward of the station line.

The frames are made of spruce. The ribs require pieces of material ⅝ by 2½ in., tapered at the top to 2 in. The bottom cross members are made of pieces ⅝ by 4 in., cut and shaped according to the stations, 3½ in. at the keel and tapered to 2½ in. at the chine. Figure 7 shows the templates used for all bottom curves. It is helpful to draw on the floor two lines meeting at right angles, and to construct the frames in relation to them, as shown in the drawing, Figure 8. Place the bottom cross members with the top edge on the line AB, the center mark on the perpendicular XY, and true up the top of the ribs by getting the proper distances from the perpendicular center line.

Fasten the ribs together with 3/32 by 1½-in. stove bolts, two at each end, placed as shown in Figure 8. Nail a brace across the top and one diagonally to help support the frames. Station 4 should have a permanent diagonal brace. Notch out for the keel chine and deck battens, as shown in Figure 4. Fasten the frames to the keel with 3/32-in. stove bolts, countersinking the heads into the keel. If the horse prevents putting in the bolts, use nails and put the bolts in later when the boat is turned upside down to plank the bottom. The frame at the step is made like all the others except that the main bottom cross member is wider and a submember is added, to which the aft bottom is fastened (Fig. 8).

Put on the chine battens (Fig. 10) and the sheer battens (Fig. 11), being sure to check both for fairness. The breast hook and keel blocks must be carefully fitted and well fastened with 1¼-in. screws. The boat must have a perfectly straight sheer, or deck line, and a fair chine curve. Tack the seam battens lightly in place halfway up the sides, mark their positions, and notch out the stem and the ribs to fit them. They are then fastened with 1-in. flat-head screws.

The side planking should be of ¼-in. mahogany. If some softer wood is used it should be ⅜ in. or ½ in. in thickness. Planking should be fastened with ¾-in. flat-head brass screws placed about 4 in. apart; or with copper nails long enough to extend through ¼ in., and be clinched on the inside. Before they are fastened on, the planks must be fitted perfectly at the seams and be given at least two coats of varnish on the inside to prevent the absorption of moisture and the consequent warping. Marine glue should be used in all plank seams and joints to insure a leakproof job.

After the sides are well fastened the deck beams are put in. They are made of ⅝-in. spruce and rounded according to the drawing, Figure 12. The curve is developed geometrically. Two dimensions are necessary for each beam; the height of the crown, which is given in Figure 13, and the sheer half breadths, given in Figure 3. The method of development is shown in Figure 12. To illustrate; the beam at Station 4 requires a piece of material ⅝ by 10 in. by 4½ ft. As the crown of the deck at this station is 6 in., draw a line AD 6 in. from the top edge and parallel to it. Now draw line AB as the center line of the station. Using 6 in. as a radius, draw the arc BC, and divide it into four equal parts. Divide the line AC into four equal parts and connect these points with those on the arc BC, which will give the lines 1, 2, and 3, and the point 4. Now measure out from the center line AB on the line AD 26¼ in., (the sheer half breadth of Station 4). Divide this distance into four equal parts and erect the perpendiculars 1, 2, 3, and 4. On these, measure up the lengths of the corresponding lines 1, 2, and 3 of the arc BC. Connect these points and you have the curve of the deck beam of Station 4. All the other beams must be developed in the same way, as the crown of the deck is not uniform. The beams are fastened to the ribs with 3/32-in. stove bolts.

A hanging knee, made of 1¼-in. oak, is bolted to the transom and to the sides with ¼-in. bolts. A sheer clamp of ¾ by 1½-in. spruce is added next and fastened to the ribs with 1¼-in. No. 10 screws. The clamp supports the aft deck beam, the diagonal deck brace, and the covering board (Fig. 15). Cut off the inside stem even with the sheer, line up the deck beams as shown in Figure 16, notch the beams for the deck battens, taper the front end of the battens to fit the sheer battens to which they are fastened with 1¼-in. galvanized brads. Other fastenings are 1¼-in. No. 8 scews.

The decks, like the planking, are made of ¼-in. mahogany, and are fastened with ¾-in. flat-head screws to the seam battens, the sheer battens, and the clamp (Fig. 17). Dress off the deck and the planking at the front end, and add the outside stem, which is fastened on with 1½-in. screws (Fig. 18). To this, fasten a ¼-in. half round of brass for stem protection. Place a 1¼-in. half round of mahogany, or other hard wood, around the top for a molding.

Unfasten the boat from the horse and turn it upside down. Put in any bolts or other fastenings which have been left out. Lay the bottom seam battens in place parallel to the keel, mark and notch out. Taper the front ends to fit the chine battens, to which they are fastened with copper nails. All other fastenings are 1-in. No. 8 screws (Fig. 10). Then dress off the side planking even with the chine all around. Plank the bottom with 5/16 by 4-in. mahogany, applying two, or better, three, coats of varnish to the inside of the planks before they are fastened on. Fasten the bottom planking with ¾-in. screws, or with copper nails in the manner directed for the sides.

After the entire outside of the hull is finished and sanded, it should be given at least three coats of good spar varnish.

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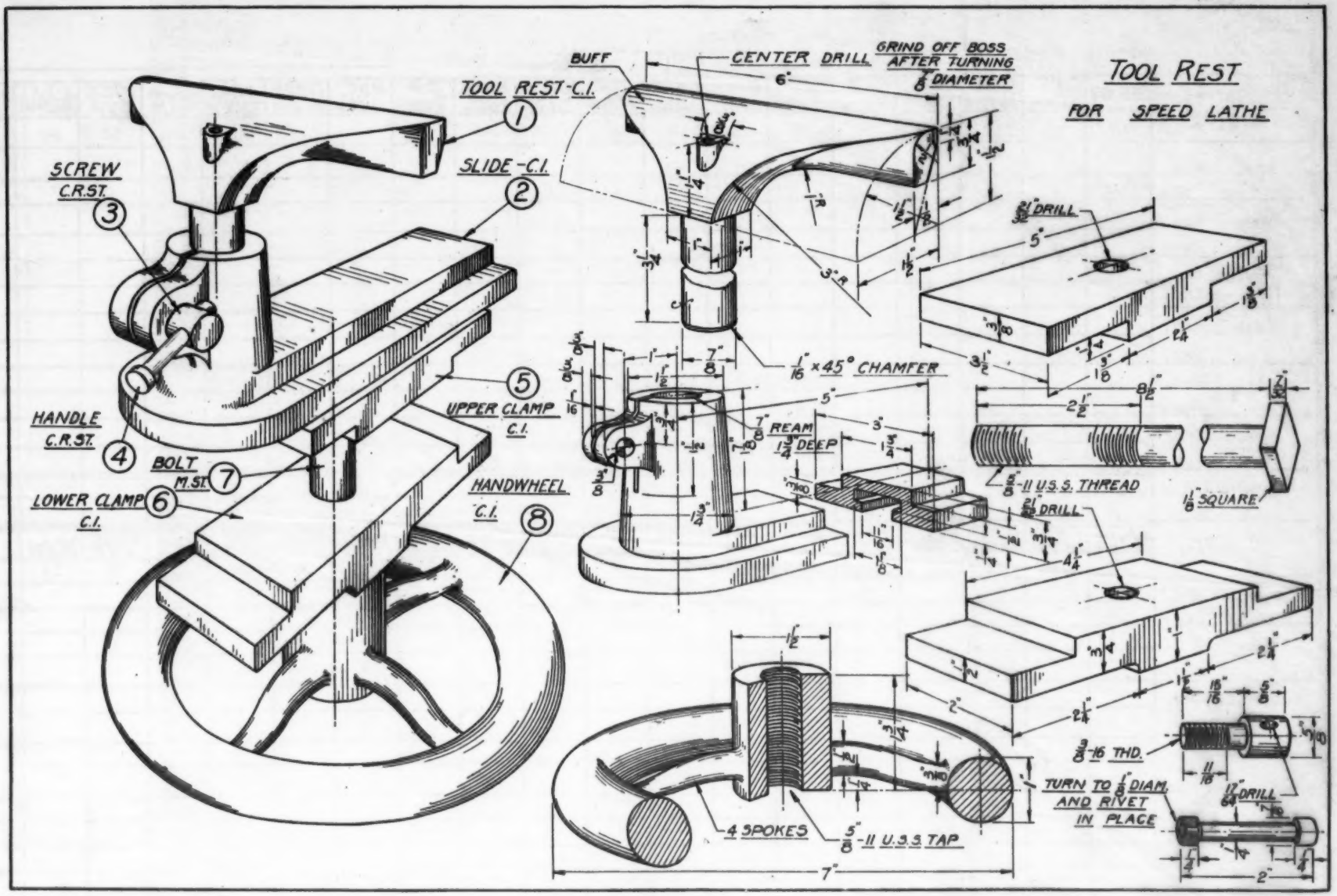
# TOOL REST
## FOR SPEED LATHE




Designed by William A. De Vette, Erie, Pa.

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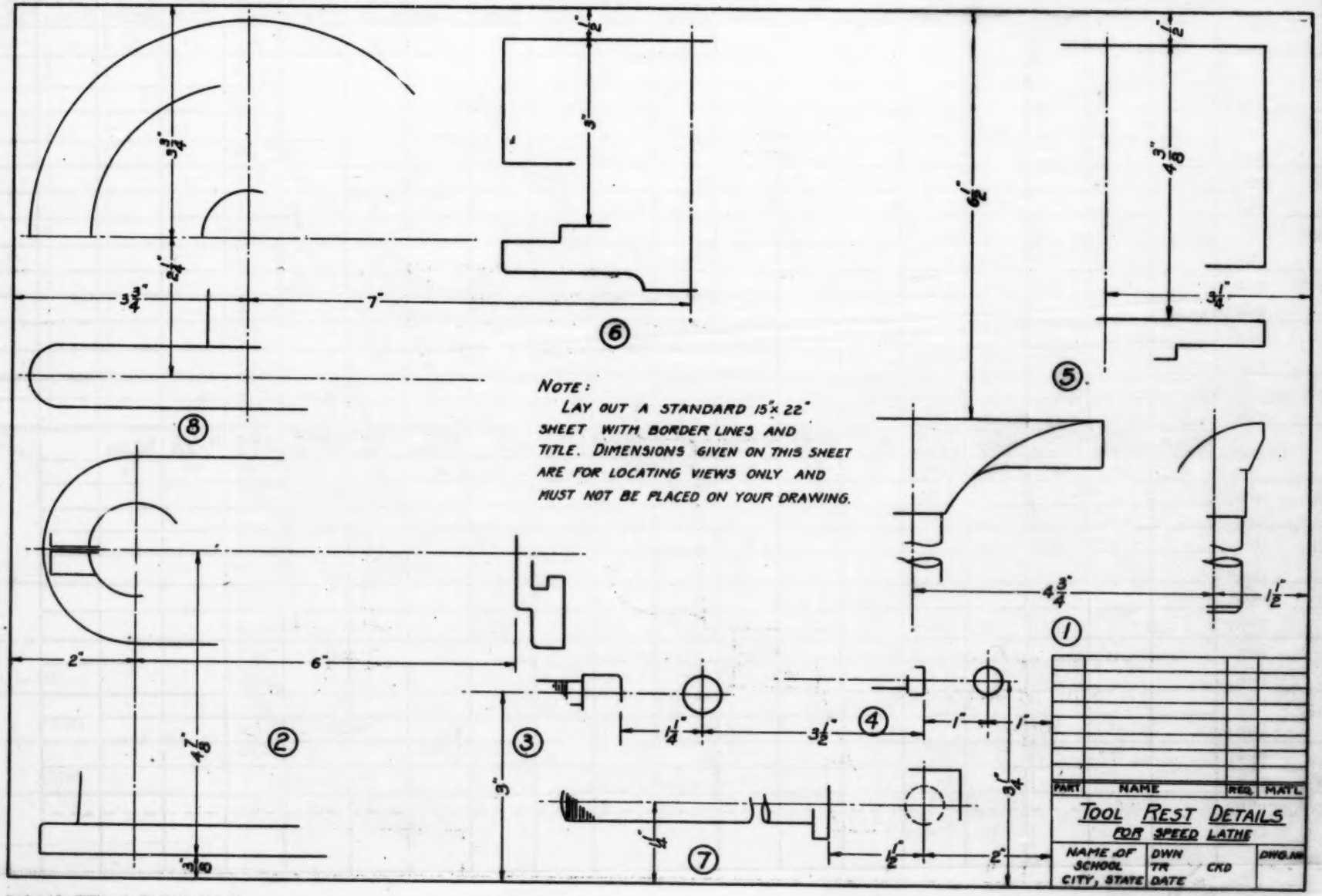


Designed by William A. De Vette, Erie, Pa.

For Description See Page 145, Industrial Arts and Vocational Education, April, 1931



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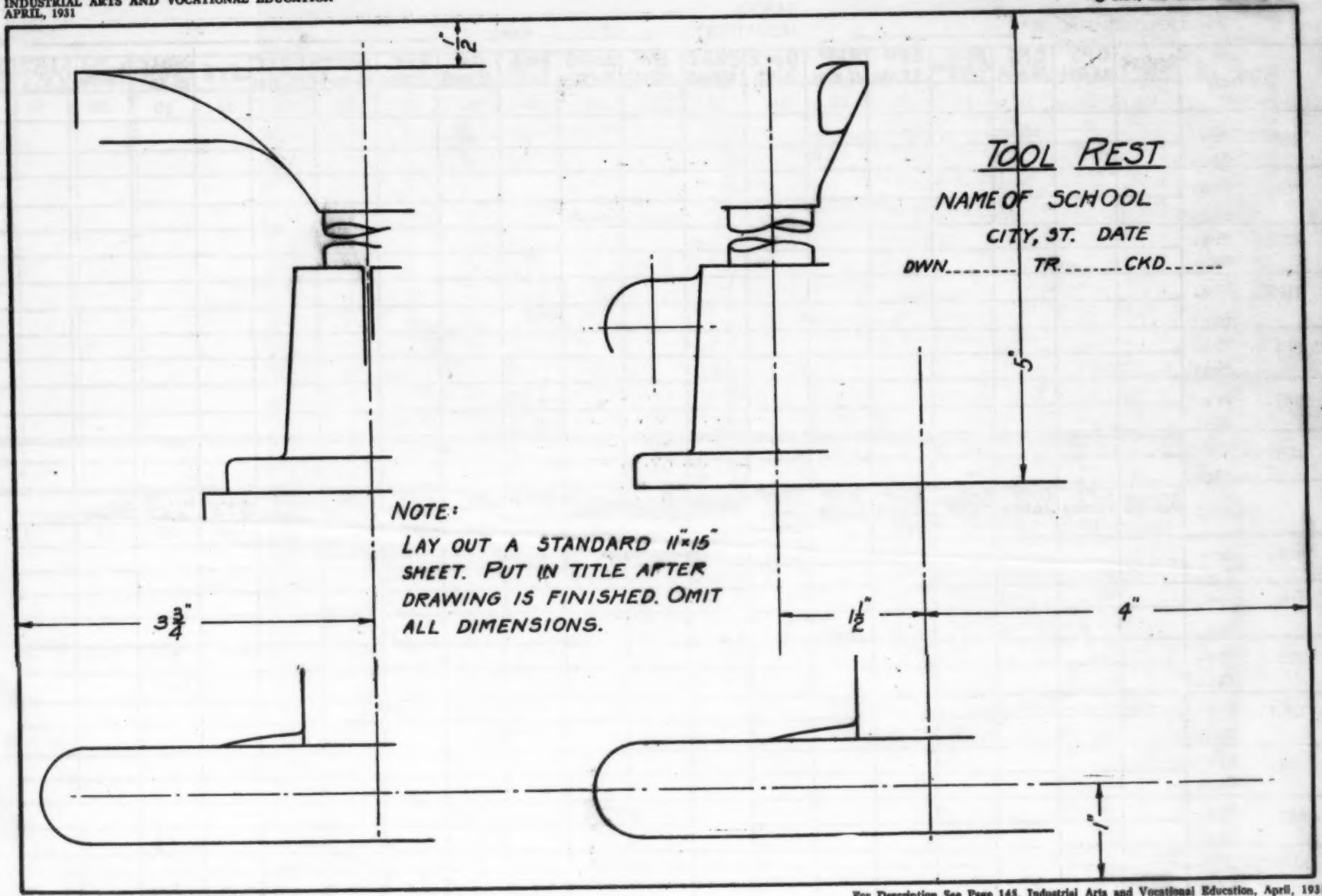


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209 - 210, April, 1931

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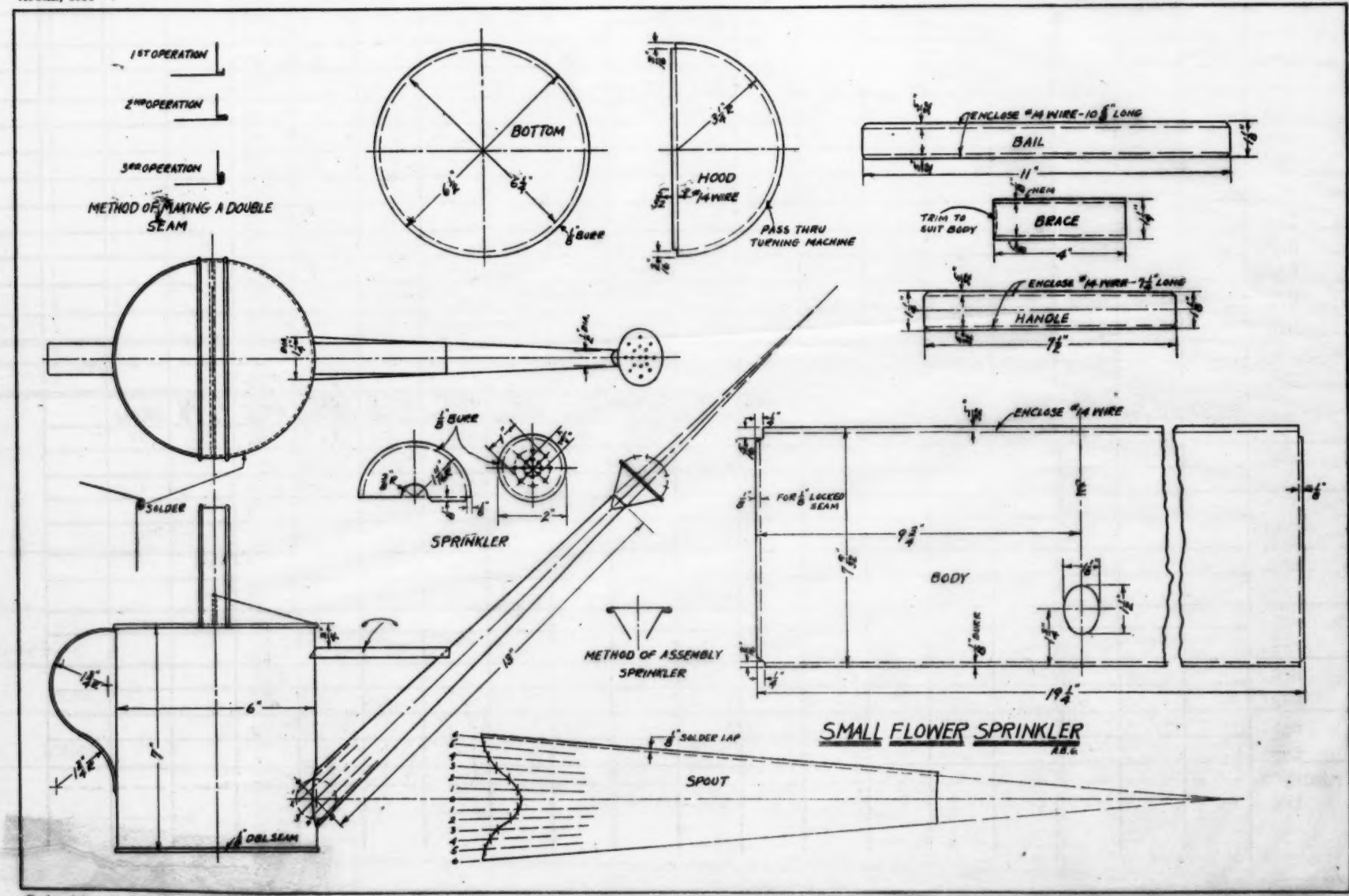
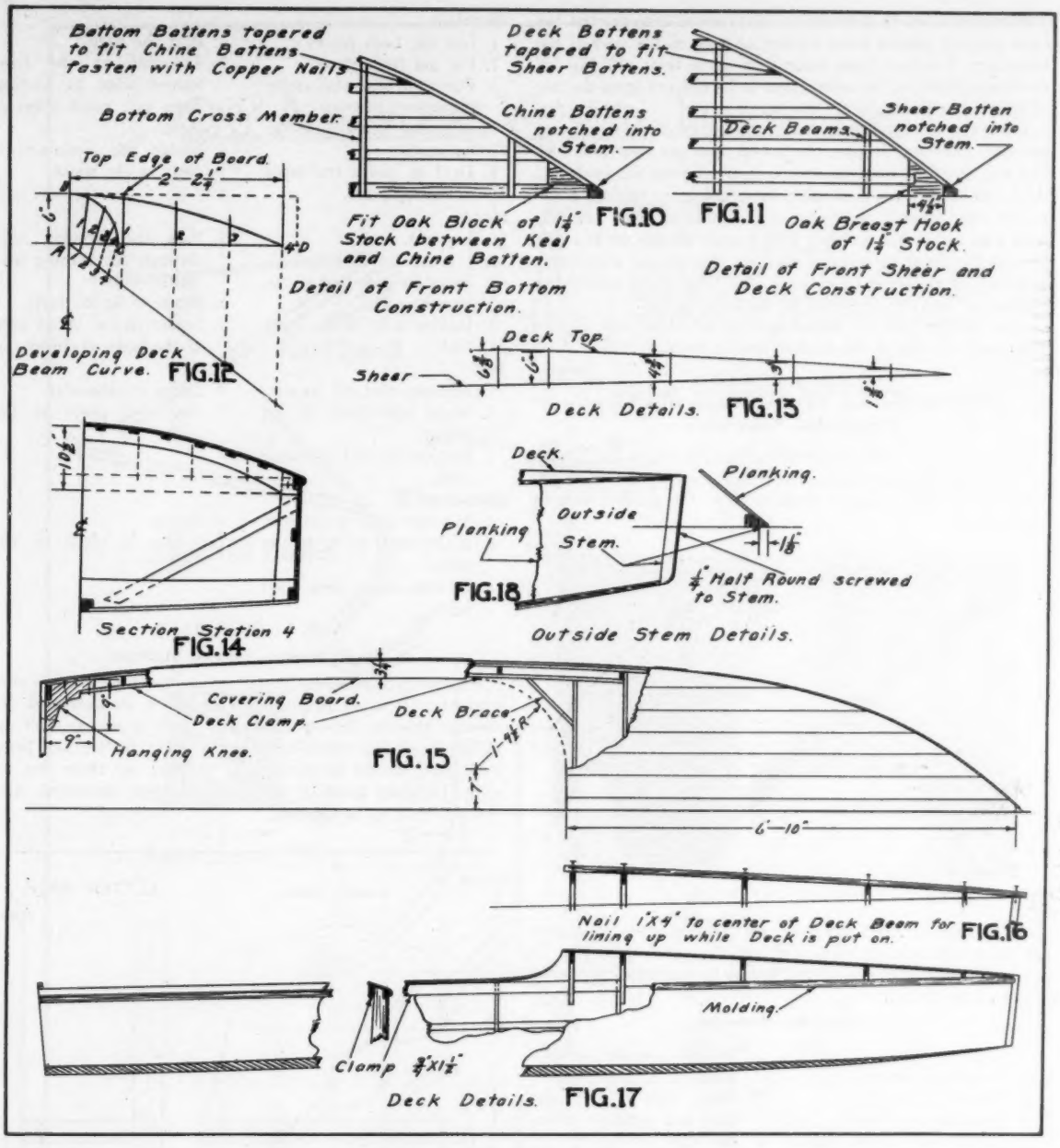



Designed by Alfred B. Grayston, Philadelphia, Pa.

For Description See Page 146, Industrial Arts and Vocational Education, April, 193




DETAILS OF OUTBOARD SPEEDSTER

A floor of ½ by 4-in. mahogany slats, varnished on all sides, should be tacked on the bottom cross members. Seats, made as desired, may be put in.

The equipment needed for this boat includes a combination light forward, a running light aft, a fire extinguisher, a life preserver for each person aboard, and, of course, the motor.

## AIDS IN TEACHING DETAIL AND ASSEMBLY DRAWING

**William A. De Vette, Erie, Pennsylvania**

(See Supplements Nos. 207, 208, and 209)

Throughout the country there may be found in use several methods of teaching students how to make detail and assembly drawings. Undoubtedly each possesses some merit.

Probably the most effective is to supply the student with a dimensioned assembly and have him make the details. This process may then be reversed with other problems by giving the student the detail or working drawings to have him make the assembly. By the use of this method the student will get the maximum development in visualization resulting from his work, because he is called upon to make views which do not exist on the assembly, and he must think through his problem in putting together the parts into a logical whole.

With students working at different speeds some will soon advance so fast that instruction becomes largely individual. In using the foregoing method the instructor usually finds himself continually answering questions concerning what views are to be drawn, how far apart they are to be placed, where they should be placed on the sheet, etc. Even then there is no assurance that the student will have room for all the details on his sheet, that he will not have to redraw some part or all of his drawing due to some oversight in locating his views.

It was with the hope of eliminating some of the above disadvantages that the accompanying illustrations were designed.

To prepare a set of instruction sheets to be blue-printed for class use will require some amount of time on the part of the instructor, but once these have been made they will pay big dividends. Some of the advantages to be derived from the use of this method are given:

First, the same problem may be used for both detail and assembly drawing. Second, the instructions are clear and concise and no effort need be wasted in untangling the problem; third, the student must visualize his problem, as there is nothing to copy. Fourth, by giving the location of views the student may attack his problem with greater confidence knowing he will not have to make a drawing over to get everything required on his sheet; and sixth, the time saved allows the student to do more problems in the same period.

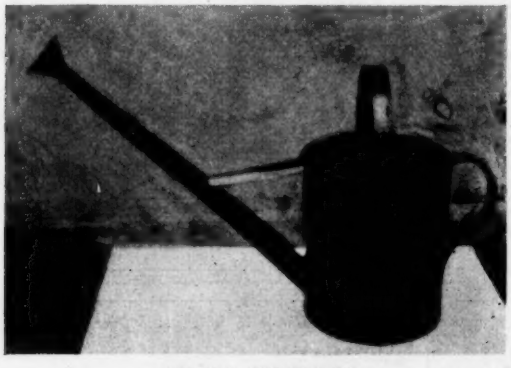
One of the greatest advantages to be noted will be the improved attitude of the student toward his work.

## SMALL SPRINKLER

**Alfred B. Grayshon, Jay Cooke Junior High School, Philadelphia, Pennsylvania**

(See Supplement No. 210)

The accompanying illustrations show a project which fits very well into the general metal shop or the general shop of the school.



A SMALL SPRINKLER

It is made of XXX tin plate and involves many operations of sheet-metal construction.

After finishing this sprinkler, it may be enameled to suit the taste of the student.

**Construction Operations**

*Body*

1. Lay out.
2. Notch the corners.
3. Chisel the hole.
4. Drawfile the hole.
5. Make single closed folds on the ends in opposite directions.
6. Make an open fold on the top edge, being careful not to close the previous folds.
7. Place wire in the open fold and complete wiring the edge.
8. Form into a cylinder.
9. Join the closed folds and lock by grooving.
10. Burr the bottom edge out.

*Bottom*

1. Lay out.
2. Cut out.
3. Burr the edge.
4. Join to the burred edge of the body by setting down.
5. Complete the double seaming as shown.
6. Run solder into the lock seam and double seam.

*Spout*

1. Lay out by development.
2. Cut out.
3. Form into necessary shape.
4. Solder the seam.
5. Solder in place over the hole of the body.

*Brace*

1. Lay out.
2. Cut.
3. Fold the single hems.
4. Shape as shown.
5. Fit to the body and spout.
6. Solder in place.

*Sprinkler*

1. Lay out both pieces.
2. Cut out both pieces.
3. Form the base and solder the seam.
4. Burr the larger diameter outward.
5. Drill or pierce the holes in the top piece.
6. Burr the edge.
7. Assemble to the base burred edge by setting down as a single seam as shown.
8. Solder the assembled parts to the spout.

*Hood*

1. Lay out.
2. Cut out.
3. Make an open fold on the straight edge.
4. Inclose wire in the open fold.
5. Pass the circular edge through the turning machine.
6. Shape to fit the body.
7. Solder to the wired edge of the body as shown.

*Bail*

1. Measure and cut to size.
2. Make open folds on the sides.
3. Inclose wire in these open folds.
4. Shape semicircular.
5. Solder in place on the body.

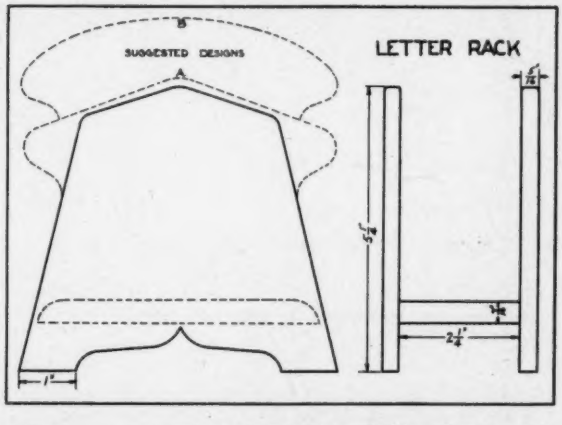
*Handle*

1. Measure and cut to size.
2. Make open folds on the sides.
3. Inclose wire in these open folds.
4. Shape.
5. Solder in place on the body.

## THE LETTER RACK

**Ira C. Madden, Detroit, Michigan**

A letter rack is a very useful article and can be made very attractive. It is an excellent first problem in woodwork for seventh graders. It is well to allow them to choose their design from models which have been made by the teacher. However, they should be encouraged to work out their own designs. Different kinds of wood may be used, depending upon the way it is to be finished.



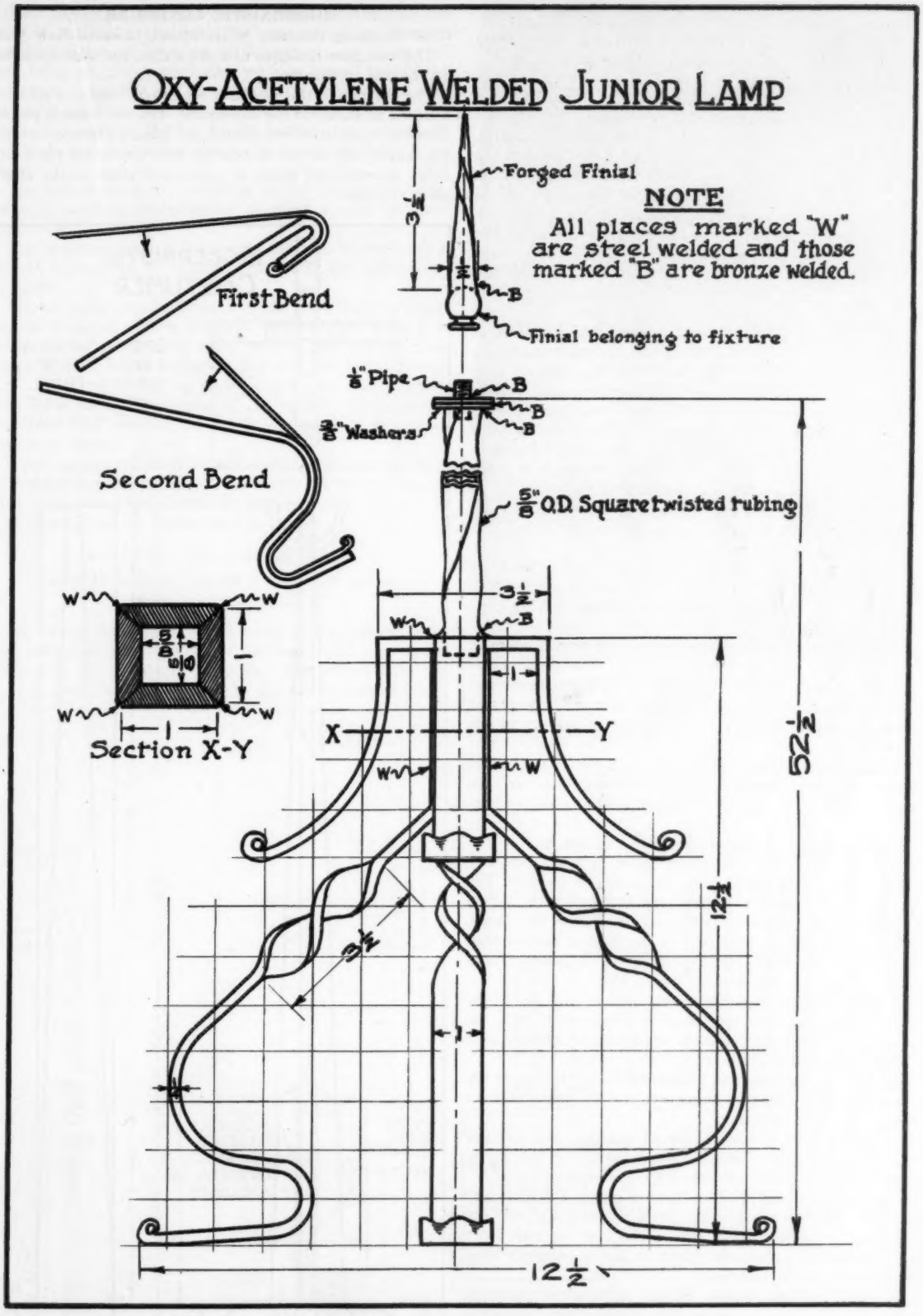

There are a number of interesting finishes that may be used. Good results may be obtained by staining and waxing. Lacquer or enamel finish, too, will be found very interesting by the pupils because of the various colors that can be used. An artistic touch may be added if silver or gold metal powder, mixed in clear lacquer or white shellac, is applied to the edges of the sides. If this is done a small transfer may be put on each side.

## OXYACETYLENE-WELDED JUNIOR LAMP

**R. F. Jennings, South High School, Minneapolis, Minnesota**

This project affords practice in both forging and oxyacetylene welding, and is at the same time simple enough for the average ninth-grade beginner to make.

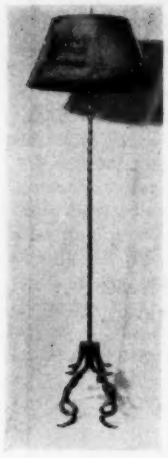
The making of this lamp logically divides itself into three




major operations; viz., (1) forging the parts, (2) welding them together, and (3) finishing with lacquer.

The following material is needed:

4 pc. ¼ by 1-in. iron, 20 in. long
4 pc. ¼ by 1-in. iron, 7½ in. long
1 pc. ½ in. square iron, 2½ in. long
1 pc. ⅝ in. O.D. square twisted tubing, 40 in. long
1 ⅛-in. pipe nipple about 1 in. long



2 ⅜-in. flat steel washers
1 electric fixture for junior lamp complete with sockets
14 ft. lamp cord
1 outlet plug
1 junior lamp shade

The first operation, forging the parts, is greatly facilitated if the curves in the legs are formed around a template as shown in the upper left corner of the drawing. This assures uniform bends and makes all the legs exactly alike. The twists are made after the curves have been formed. Hammer marks which give the "handmade" effect should be put on before the bending is done.

The four pieces curving downward at the top of the legs are made separately from the rest of the legs and are later welded on. They are first upset to form a sharp right-angle bend and afterward curled at the ends and bent as shown in the drawing. It is important to get a sharp edge on the right-angle bend as this greatly improves the appearance of the lamp. Care should be taken to make these pieces as much alike as is possible.

The finial at the top is forged out of ½-in. square iron and is given a full twist. It is later bronze-welded to the ball that screws into the top of the fixture.

To prepare for the second step or the welding, the edges of the legs should be chamfered as indicated in section X-Y of the drawing. This may be very readily and quickly done on the emery wheel.

The legs of the base are next tack-welded to hold them in place and then securely welded together with ripple welds along the edges in contact. By using a semicircular movement of the welding torch a smooth, uniform weld can be produced that in no way detracts from the artistic appearance of the lamp.

The top pieces of the base are next tack-welded to the legs and carefully bent into their proper positions. They are then firmly welded to the legs with a ripple weld of good penetration.

After cleaning the top of the base and one end of the square, twisted tubing with emery cloth, or better yet with a sand blast, the tubing is ready to be welded in place. The base should be heated to a cherry-red heat before the tubing is inserted to prevent overheating the thin wall of the tubing. Only the envelope or outer part of the welding flame should be used for this bronze-welding operation. Sufficient bronze should be run into the joint to form a fillet.

In bronze-welding the finial to the ball on the top of the electric fixture, extreme care must be taken not to heat the brass ball over a dull red before the bronze is applied, as it is very easy to melt the brass.

The two washers are next bronze-welded to the top of the tubing and the ⅛-in. pipe nipple welded into the hole in the washers by the same means.

The metal work is now completed and the third and last step, the finishing, is in order. All parts should be thoroughly cleaned and smoothed carefully with emery cloth.

One coat of black brushing lacquer makes a satisfactory finish if the undersurface has been properly cleaned and smoothed. A pleasing effect can be produced by high lighting all edges with aluminum paint. If this is skillfully done the effect is that of polishing.

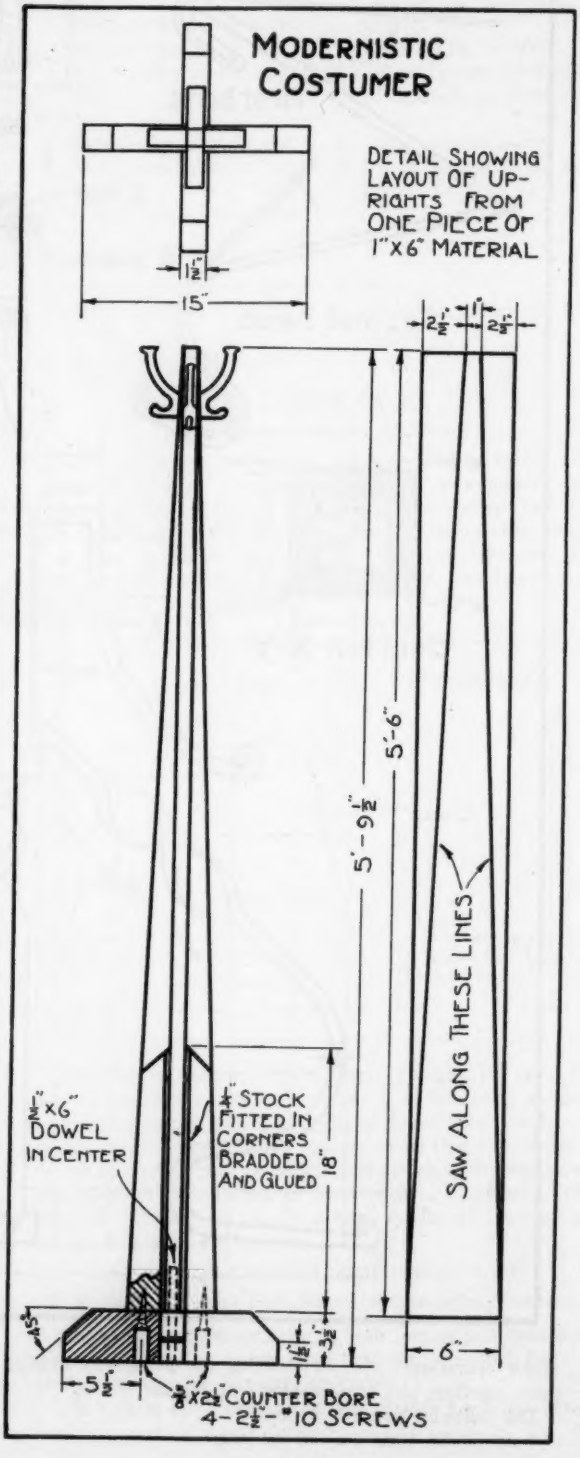
To apply the high lighting, dip a 1-in. brush in aluminum paint and paint most of it out on a board. Then proceed to touch the edges of the metal with the side of the brush. The hammer marks can be brought into prominence by going over the hammered surfaces lightly with a semidry brush that has previously been dipped in aluminum paint.

## MODERNISTIC COSTUMER

**C. D. Schelleng, Academy Street School, Oneonta, New York**

This costumer is simple to make and at the same time has a very fine appearance.

The uprights in this costumer are sawed from one piece of material as shown in the illustration. The two outside pieces, after the edges have been planed and jointed where necessary, are turned end for end in relation with the center piece and either doweled and glued, or nailed and glued to the larger piece as shown.



Next, the corner pieces are fitted. These are cut in pairs out of ¼-in. material in somewhat the same manner as that used for the uprights. If the edges of these pieces are jointed before being cut, the jointed edge may be turned toward the corner for a good fit and the outside edges planed true with the main members after the small pieces have been glued in place. The angle at the top of the corner pieces should, of course, be cut and planed before the pieces are fastened in place.

The base is made of two pieces of 1½ by 3½ by 15-in. material, carefully center-lapped to make a solid and true foundation.

The upright section is fastened to the base by means of a piece of ½-in. dowel rod, placed in the center, and four screws, as shown.

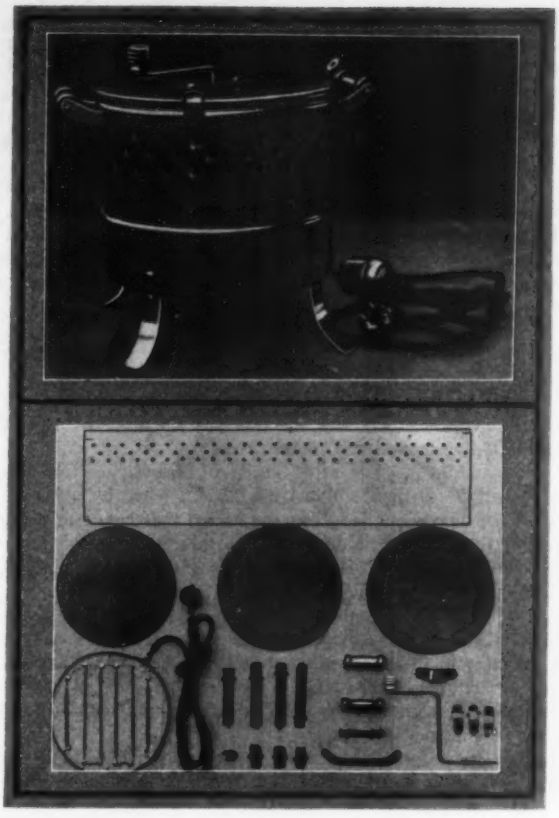
The costumer may be finished natural, or it may be enameled or lacquered. Where a natural finish is to be used, it is better not to use finishing nails, and the job also will look better with the edges stained darker than the body. This is particularly true of the top edges of the ¼-in. inserts where they slant toward the center of the upright. These should stand out well whether the finish is natural or two-toned lacquer or enamel.

Where lacquer or enamel is used, it is all right to use finishing nails in the construction provided they are set well in and filled with putty. Also, where lacquer or enamel is used, it is possible to use the cheaper woods.

## ELECTRIC POP-CORN POPPER

**Burton H. Rowley, Lathrop Junior High School, Santa Ana, California**

The electric pop-corn popper is a very interesting and practical project in sheet metal and electricity, and a great favorite with the junior-high-school boy. The project gives the pupil a great variety of things to do, and familiarizes him



TOP, FIG. 1. THE CORN POPPER READY FOR ACTION
BOTTOM, FIG. 3. THE PARTS OF THE POPPER

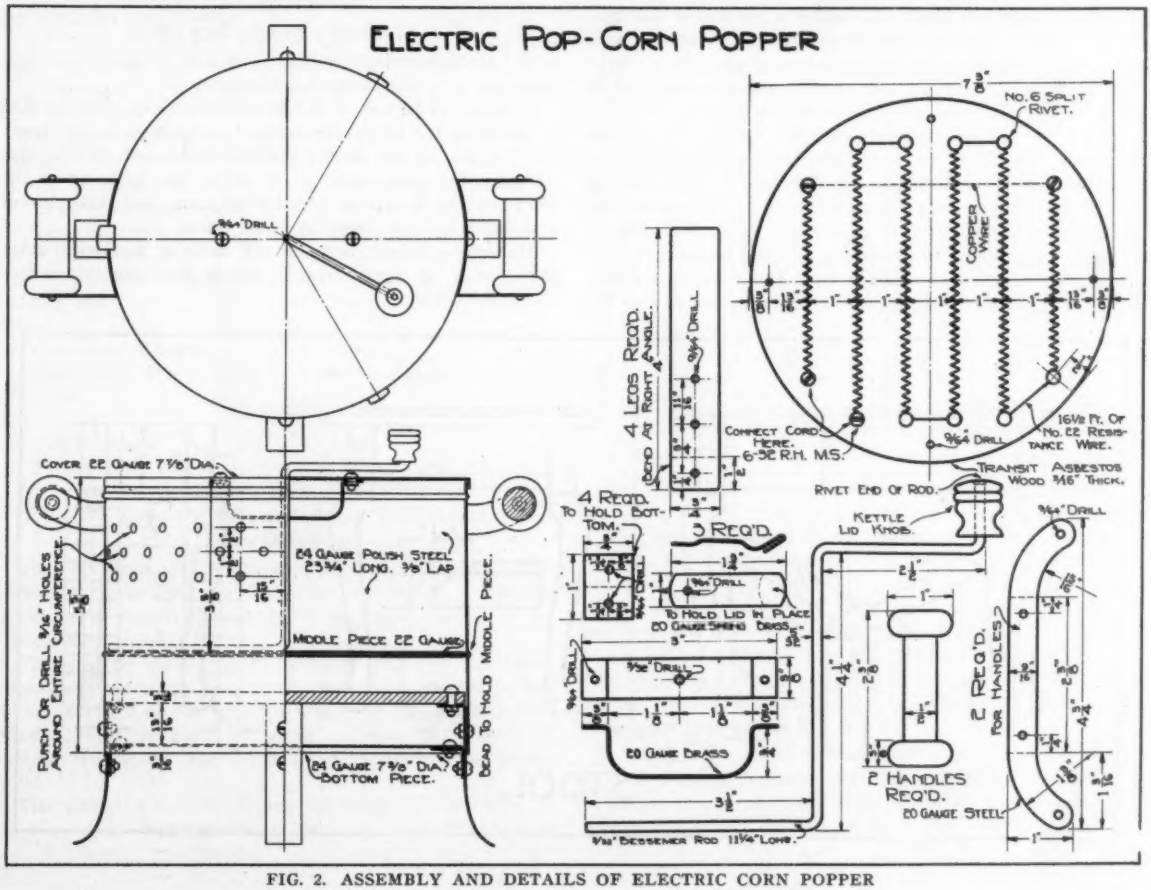

ELECTRIC POP-CORN POPPER
No. 6 Split Rivet.
Copper Wire
4 Legs Req'd.
Bend At Right Angle.
Connect Cord Here. 6-32 R.H. M.S.
16½ Ft. Of No. 22 Resistance Wire.
Transit Asbestos Wood 1/16" Thick.
Rivet End Of Rod.
Kettle Lid Knob.
4 Req'd. To Hold Bottom.
3 Req'd.
To Hold Lid In Place
20 Gauge Sheet Brass
2 Handles Req'd.
20 Gauge Steel
2 Req'd. For Handles
Cover 22 Gauge 7⅜" Dia.
24 Gauge Polish Steel 23¾" Long. ⅜" Lap
Middle Piece 22 Gauge
Punch Or Drill 9/16" Holes Around Entire Circumference.
Bend To Hold Middle Piece.
24 Gauge 7⅜" Dia. Bottom Piece.
20 Gauge Brass
9/16" Bessemer Rod 11¹⁵/₁₆" Long.

FIG. 2. ASSEMBLY AND DETAILS OF ELECTRIC CORN POPPER

with the different sheet-metal machines, such as the squaring shears, bar folder, forming rolls, and beading and burring machine. He also obtains experience in brazing and nickel plating.

The body of the popper is made of a piece of 6 by 23¾-in. No. 24 gauge extra-deep drawn steel. The holes are drilled or punched according to the dimensions shown in Figure 2. On one end notch out the corners, 1/4 by 3/16 in. Fold a 3/16-in. edge in the bar folder on the top and bottom edges. Then place the piece in the forming rolls and form it into a cylinder with folded edges inside. An outward V-shaped bead is placed 3¾ in. from the top edge to hold the middle piece, which forms the bottom of the popper, in place.

Cut two disks, one for the middle piece, 7¾ in. diameter, and one for the top, 7⅞ in. diameter of No. 22 gauge polished steel. Also one disk for the extreme bottom, 7⅜ in. diameter of No. 24 gauge steel. The top and middle pieces are each burred over 1/16 in. The holes in the top disk are drilled, and it is then buffed and nickel plated.

The middle piece is fitted inside of the popper into the V-shaped bead, then temporarily held in place by a clamp. Then the lap of the body piece is brazed together, care being taken not to overheat or to pile too much brazing material on the joint. After this has been done, the middle piece is held firmly in place by the V-shaped bead.

The body is now buffed with different grades of emery until all scratches and rough places have been removed. Another bead may be added for strength and appearance at the very top of the popper. The body is then ready for nickel plating, and should be put through the proper dipping solutions and then plated.

The four legs and two handles should be made of No. 20 gauge polished steel. Drill all holes, buff, and nickel plate before bending.

The 16½-ft. of No. 22 gauge nichrome resistance heating wire is wound on a ⅛-in. piece of Bessemer rod. The rod is turned in a hole in a block of wood with the aid of the drill.

The asbestos wood disk should be cut to shape with a hack saw and then finished with a coarse emery wheel or a coarse file. The holes are drilled and the heating element held in place by the split brass rivets and machine screws.

A piece of 5/32-in. Bessemer rod 11¼ in. long is used for the crank. This may be nickel plated also if desired. The kettle-lid knob is held on the Bessemer rod by just riveting the end of the rod over, allowing the knob to turn on the rod.

The other necessary parts are clearly shown in Figure 2. All parts when ready for assembling are held together by 6 — 32 r.h. nickel-plated machine screws. The popper complete, with 6-ft. cord, nickel plating and everything, costs about $1.

## ELEMENTS OF JOB COMPOSITION — I

**Frank P. Rich, Roxbury Memorial High School, Boston, Massachusetts**

### Essentials of Good Typography

In order to produce good typography, it is essential to know the fundamental principles underlying correct composition. The printer must have those principles so firmly in mind that he will use them automatically, just as the writer must know how to give the different letters of the alphabet their individual and correct forms.

The following elements should always be considered when planning a job:

*Proportion.* Proportion has been aptly defined as "the pleasing inequality in the parts of an object." The panels, borders, groups of text, or whatever else makes up the printed pages, must not only vary in size, but the variation must be pleasing.

*Optical Center.* Anything placed in exact center has the appearance of being below center. The optical center is slightly above the geometrical center.

*Balance.* Care should be taken to have the different groups of type in perfect balance.

*Shape Harmony.* All shapes in a piece of work should have something in common.

*Tone Harmony.* Type, rules, borders and ornaments should be uniform in tone. Use but one type series if possible.

*Color Harmony.* Keep the page cool in tone. Use the warm colors sparingly.

*Appropriateness.* No matter how well grouped or well balanced, if the type selected is not appropriate to the subject it is a dismal failure.

Use but one type face if possible and make sure that it is appropriate for the job. Do not set a job for an iron foundry in a series of Text or a church program in a heavy block type.

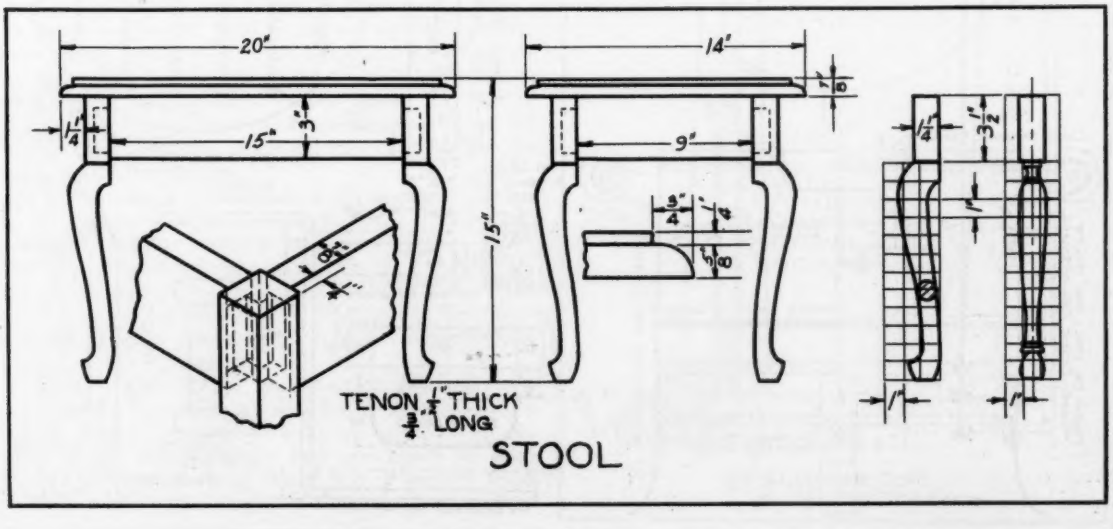
## STOOL

**P. C. Hoopes, Roselle, New Jersey**

The stool described herewith also may be used as a fern stand, or as a depository for magazines.

A choice of turned or cabriole legs is given. The method of fastening the top to the frame is not shown in the drawing, but any of the several methods will prove satisfactory. Although the detail calls for ½ in. as the thickness of the rail tenon, ⅜ in. will be found satisfactory and really leaves a stronger leg than does the ½-in. tenon.

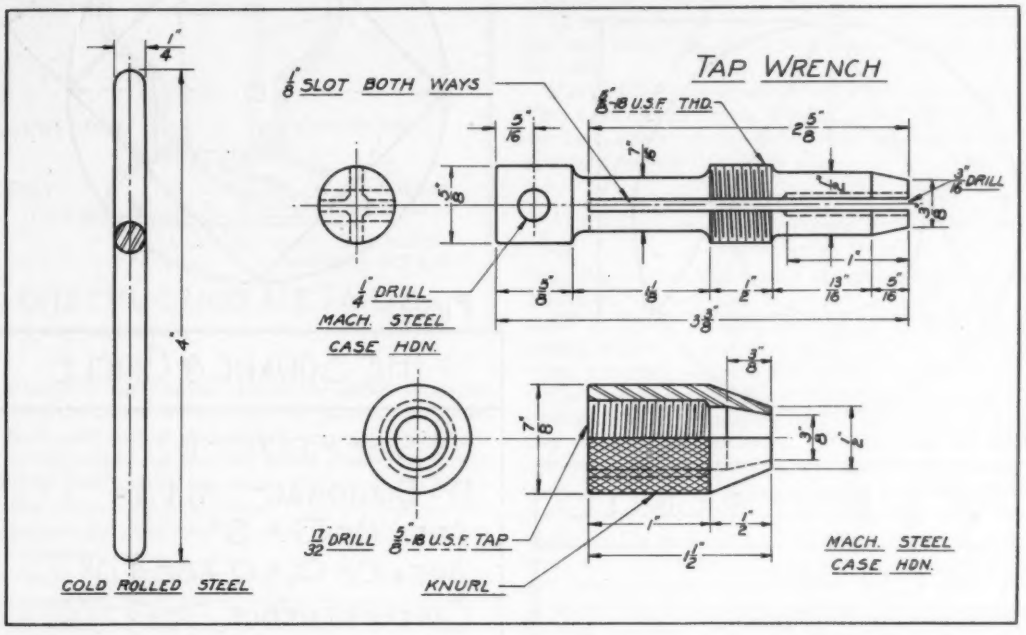
Mahogany, walnut, or birch will make up well with either the cabriole or turned legs. If oak is used, the turned legs will look better.



## TAP WRENCH

**E. C. Youngbluth and W. A. De Vette, Erie, Pennsylvania**

A tap wrench such as shown in the accompanying drawings is a welcome addition to any boy's tool kit and particularly to those interested in building small models and other articles of like nature.




The operations involved in making the wrench are straight, taper, and between-shoulder turning; drilling; tapping; threading; slotting; and knurling.

The material required for the tap wrench is cold-rolled steel: one piece 11/16-in. diameter by 3 7/16 in., one piece 1-in. diameter by 1 9/16 in., and one piece ¼-in. diameter by 4 1/16 in.

The order of operations is as follows:

*Shank*

1. Cut stock to length.
2. Center and center-drill.
3. Face to length.
4. Straight turn.
5. Turn between shoulders and end.
6. Turn taper.
7. Thread for nut.
8. Polish.
9. Drill hole in end.
10. Drill for bar.
11. Slot.

*Nut*

1. Cut stock to length.
2. Drill, ream, face and tap.
3. Turn.
4. Knurl.
5. Taper turn.
6. Polish.

*Bar*

1. Cut to length.
2. Face ends.
3. Polish.

## A METAL END TABLE

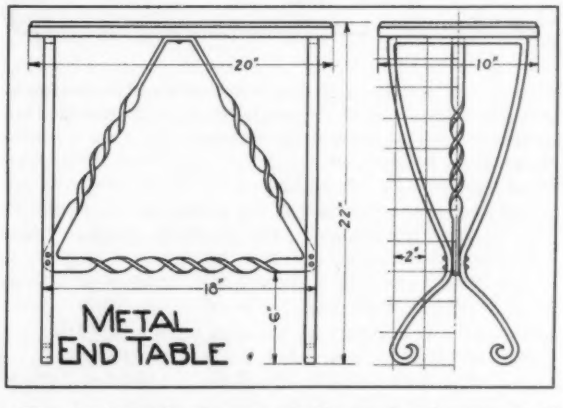
**J. W. Bollinger, Roosevelt Junior High School, Tulsa, Oklahoma**

The end table, shown herewith, while not so highly ornamental as some end tables are, is nevertheless a pleasing design. It is especially suitable for beginners, because of its comparative simplicity.

The ends are made of 3/16 by ¾-in. strap iron, cut 54 in. long. Bend the pieces so as to leave 8 in. in the center and 23 in. for each of the legs. To shape the legs, make a full-sized drawing of them on paper to serve as a guide in making the curves. The bending can be easily done on the anvil.

The stretcher and the braces are made of one piece of 3/16 by ¾-in. iron, cut 58 in. long. The most difficult part of the job here is to make the two bends, which will leave the stretcher 18 in. long and approximately, 20 in., for each of the braces. The bends are made over the nose of the anvil. It will be necessary to prevent the material from buckling out of shape by laying it on the face of the anvil and smoothing it with the help of the flatter and sledge.

Mark out the portions it is desired to twist, clamp the metal in the vise at one of these lines, grasp it at the other line with a monkey wrench, and twist the work through the number of revolutions it is desired to make.




The top is made of some suitable wood and measures ¾ by 10 by 20 in. The top may be made of various designs.

The legs are riveted to the braces as shown in the illustration. The center portion of the legs and the ends of the braces are fastened to the top by means of 1-in. screws.

The top may be finished with the usual stain and varnish, and legs painted black, or the entire table may be enameled in some bright color such as green or red, to harmonize with the furnishings of the room into which the end table is to be put. A beautiful finish may be produced with the help of lacquer and an air-gun outfit.

## INSCRIBED FIGURES

**H. P. Polson, Technical High School, Oakland, California**

The chart on inscribed figures which accompanies this article, and similar charts have been found very useful in cor-

## INSCRIBED FIGURES

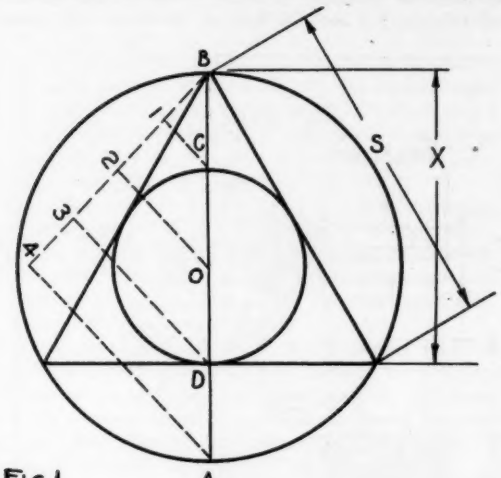



FIG. 1

### THE TRIANGLE & CIRCLE

S = SIDE = 1.153 X
X = ALTITUDE = 0.866 S
AREA = 0.433 $S^2$ OR 0.577 $X^2$
DB = ¾ OF AB
DC = ⅔ OF DB

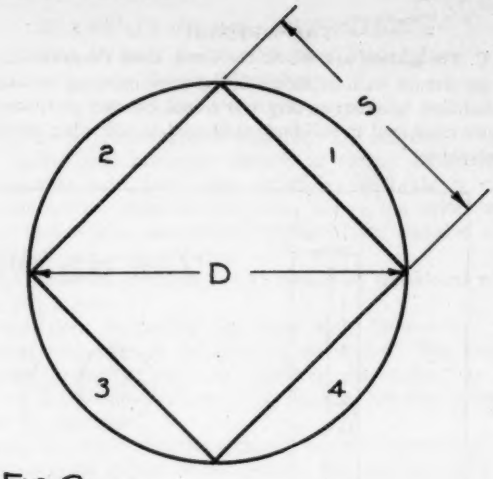



FIG. 2

### THE SQUARE & CIRCLE

S = SIDE = 0.707 D
D = DIAGONAL = 1.414 S
AREA OF □ = $S^2$
AREA OF O = 0.7854 $D^2$
CIRCUMFERENCE OF O = Dπ
RADIUS = D ÷ 2
AREA OF THE SEGMENTS =
AREA OF O − AREA OF □

relating shop drawing and shop mathematics. The two problems which form part of the article illustrate the use that can be made of this material in the classroom.

*Problem 1 — Figure 1*

Let diameter of circle AB = 3 in.
Then DB = ¾ × 3 = 9/4 = 2¼ or 2.25 in.
Since DB = the altitude of the inscribed triangle
Then X = 2¼ or 2.25 in.
Then S = 1.153 X = 1.153 × 2.25 = 2.58825 or 2.59 or 2 19/32 in. (approximately)
Since DC the diameter of inscribed circle = 2/3 DB
Then DC = 2/3 × 2¼ = 2/3 × 9/4 = 18/12 = 1½ in.
Area of triangle = 0.433 $S^2$ = 0.433 × $(2.59)^2$ = 0.433 × 6.9081 = 2.9912073 sq. in.
Area of circle DC = 0.7854 $D^2$ = 0.7854 × $1.5^2$ = 1.7671 sq. in.
Area of circle AB = 0.7854 $D^2$ = 0.7854 × $3^2$ = 0.7854 × 9 = 7.0686 sq. in.

*Problem 2 — Figure 2*

Let diameter of circle = 3 in.
Then S = 0.707 D = 0.707 × 3 = 2.121 in.
Area of square = $S^2$ = $(2.121)^2$ = 4.498641 sq. in.
Area of circle = 0.7854 $D^2$ = 0.7854 × $3^2$ = 0.7854 × 9 = 7.0686 sq. in.
Circumference of circle = πD or 3.1416 D = 3.1416 × 3 = 9.4248 sq. in.
Area of segments = Area of circle — Area of square = 7.0686 — 4.498641 = 2.569959 sq. in.
Radius of circle = D ÷ 2 = 3 ÷ 2 = 1½ or 1.5 in.

## ELECTRIC LANTERN

**Robert L. Barnes, Lancaster, Pennsylvania**

Imitation lanterns, filled with candy, may be transformed into real lanterns, electrically lighted, without much trouble. When thus transformed, they make quite attractive mantelpiece decorations. As night lights they are also very useful and appropriate.

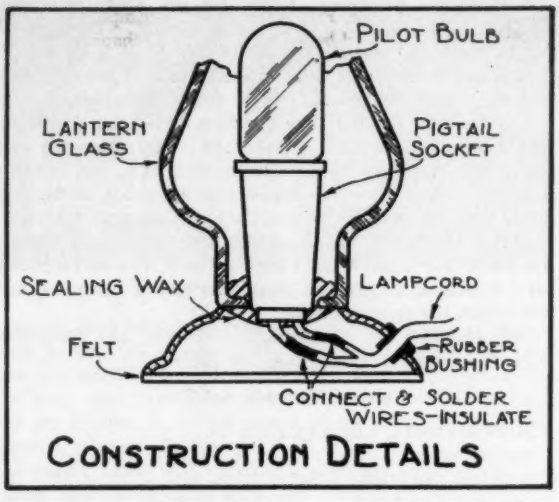
The imitation lanterns may be bought from any railroad-station news stand, or from the 5 and 10 cent store.

### Construction

In transforming this imitation lantern into a real lantern, it is necessary to cut a hole through the bottom of the glass section. This is done by using a three-cornered file ground as shown in the sketch.

The drilling must be done slowly, using turpentine as a lubricant. After a hole has been bored through, a round file is used to round out the irregular circumference. Both files may be held in a small hand drill for this boring operation.

After the hole has been drilled, the pigtail candelabra socket is next put into the glass, the wire being brought through the hole just drilled. Some sockets will not enter the top of the glass, but a little filing will soon make possible their insertion.




Tissue paper is next stuffed around the socket inside the glass to keep the socket in the center. The glass is then turned upside down and sealing wax melted into and around the bottom of the socket and the hole in the glass. This fastens the socket in place and the next thing to do is drill a hole in the tin base of the lamp large enough to accommodate a rubber bushing or some other insulating material which fits snugly over the extension cord.

After the bushing has been put in position, the extension cord is inserted through it and the ends of the wire scraped to remove the insulation. The pigtails are then cut off within 2 in. of the socket, and the ends of these wires also are scraped. The extension cord is next spliced to the short stubs on the pigtail using a Western Union splice, then solder the joints, tape with rubber tape, and then with friction tape.

THE FINISHED PROJECT

Small pieces of lead are next scattered inside the base of tin to make it heavy. The rest of the base is filled up with plaster paris.

A piece of felt is then glued to the bottom to protect any polished surfaces on which the lamp may be used.

A plug fastened to the other end of the extension cord finishes the electrical work on the job.

To protect the tin from rust, a coat of red lacquer on the top and bottom tin, and a coat of green on the handle may be used.

Many of the boys in our school have made these lanterns. They have created a great interest and the pupils have learned the fundamental electrical principles involved in the wiring of a light through this simple job.

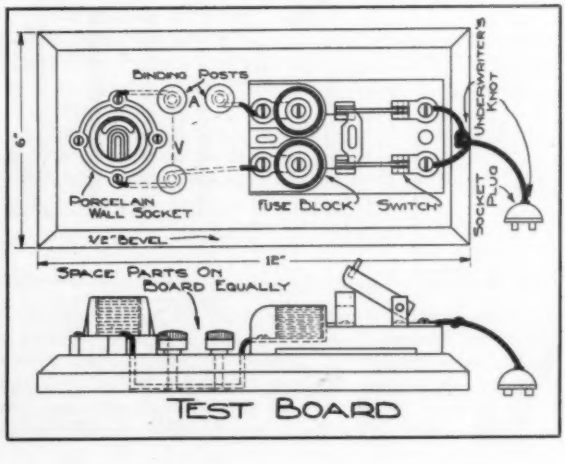
## THE ELECTRIC TEST BOARD

**I. G. Terry and W. A. Dickinson, Senior High School, Marshalltown, Iowa**

In the average high-school electrical shop with its large enrollment the instructor is often at a loss for the first few weeks in finding suitable construction projects for the beginning student. It was because of this that the electric test board described herewith was chosen. It is a device which can be easily constructed and immediately put to use by the student. It is quite inexpensive, too, because if all the necessary materials are purchased, the total cost will fall below one dollar. But many of the articles may be brought from home by the student, thus making the cost almost negligible. Furthermore, the project gives to the beginning student a review of his mechanical drawing and woodwork and at the same time introduces him to new work such as soldering and wiring electric circuits. In this way, it serves as a sort of connecting link, binding together the work the student has had in industrial arts with what is to come.

The student who has taken mechanical drawing will readily make the drawing of the board, but even the student who has not had a regular course in drawing will have little trouble with this part of the work. The simple woodwork involved in cutting, beveling, sanding, and staining the baseboard is conducive to creating interest in good workmanship at the very beginning of the electrical course. The soldering and wiring which follow, will further emphasize the idea of good workmanship and neatness.

As soon as the project is completed the student will want to make use of it, hence this is a good time to teach him the proper connections for the voltmeter and ammeter in the electrical circuit. The construction of the project and its immediate use in this way usually fixes in the mind definitely this idea of meter connections. The student also will be eager to work out the relations found in Ohm's law. This can easily be done by leaving the meters connected to the binding posts and inserting the plug of an electric iron or



soldering iron, a light bulb, or any other electric heating device in the socket on the board and taking the meter readings.

Later on in the course the test board will prove valuable in testing for short circuits. In repairing electrical devices and in radio construction a simple and convenient method of testing for short circuits is quite essential, as the amateur will usually resort to much guesswork if a testing device is not at hand. All that is necessary to convert the test board into a short-circuit tester is the simple matter of connecting two short pieces of extension cord on the terminals marked A and inserting a small light bulb in the socket.

Some of our students have also used the test board for testing various types of fuses. This is done by connecting a high-range ammeter to the binding posts marked A and inserting the different types of fuses in the socket. In testing fuse wire to find the current necessary to fuse it, the threaded portion of a separable plug may be inserted in the socket, and two small copper strips placed in the openings in the plug so that they project a little above it. Then about ¾ in. of fuse wire may be placed across these copper strips and the current turned on, and the ammeter will record the current necessary to melt the fuse wire.

With a little ingenuity on the part of the student some of these materials, such as the binding posts, fuse block, fuses, and double-pole switch may be made in the shop. In making the fuse block the threaded portions of old, discarded sockets were mounted on old pieces of radio panel. Old burned-out fuses were repaired with 5-ampere wire, and the switch was constructed by some of the pupils from pieces of old copper strips and old radio panels.

**Procedure**

The following procedure was found to be effective in creating interest in the project and in fostering good habits in workmanship in doing the construction work.

1. *Drawing.* Require a good working drawing showing dimensions, drilled holes, mountings, and a list of materials.

2. *Preparing Baseboard.* Emphasize and apply principles used by the woodworking mechanic in cutting, planing, sanding, beveling, and staining the baseboard.

3. *Mountings.* Mount with care and with distances equalized, the socket, fuse block, switch, and binding posts.

4. *Soldering.* Practice tinning iron and soldering joints before attempting soldering on the test board. Measure and cut proper lengths of insulated wire. Strip ends, put through holes and solder on clips. Solder wire on heads of binding posts. Strip one end of extension cord and solder on two clips.

5. *Wiring.* Attach clips to sockets and switch. Fasten binding posts. Tie Underwriter's knot on each end of extension cord. Attach clips to switch. Strip other end of extension cord and attach the separable plug.

Following is a list of materials, their cost, and the procedure we have used in assigning this project.

**List of Materials and Cost**

| | |
|---|---|
| 1 hardwood board, 1 by 6 by 12 in. | $ .05 |
| 3 binding posts | .08 |
| 1 porcelain mountable socket | .10 |
| 1 porcelain fuse block | .20 |
| 2 5-ampere fuses | .10 |
| 1 double-pole switch | .20 |
| 1 ft. insulated wire | .01 |
| 3 ft. extension cord | .05 |
| 1 separable plug | .10 |
| 6 small connector clips | .05 |
| 6 1-in. wood screws | .05 |
| Total | $0.99 |

## A GARDEN GATE

**Horace E. Boggy, Technical High School, Indianapolis, Indiana**

The garden gate illustrated and described in this article was designed as a structure that could be made in the small wood-

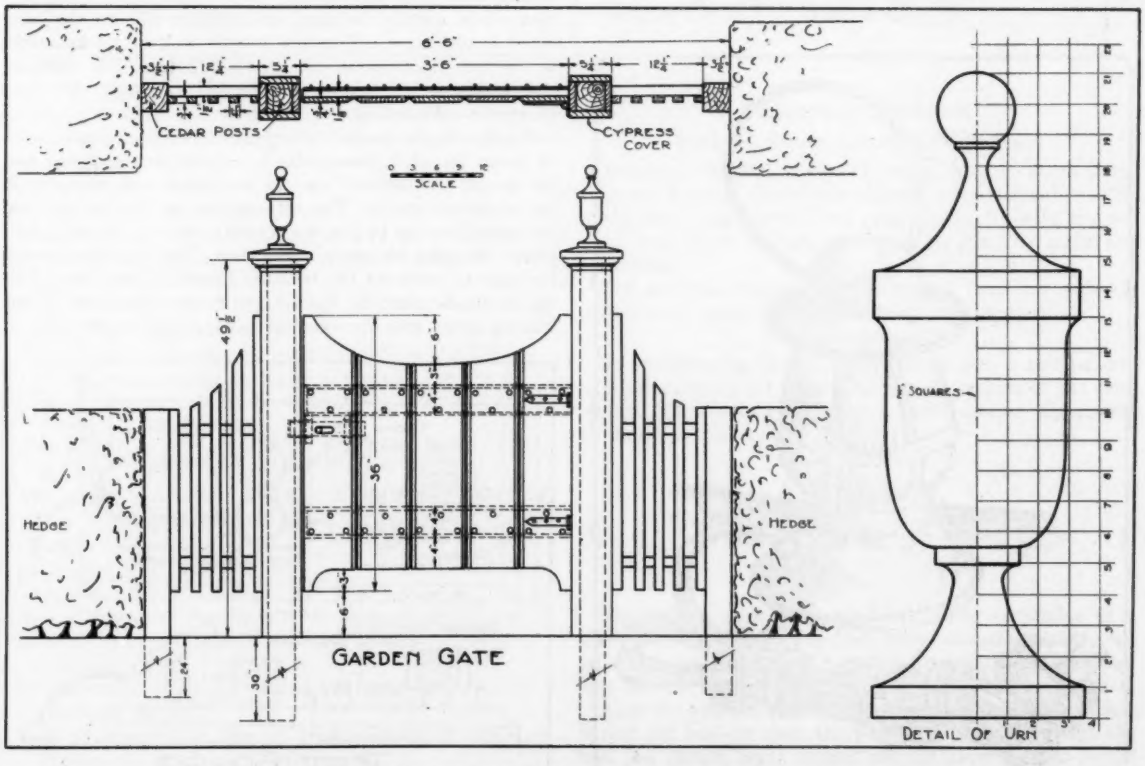



FIG. 1. DETAILS OF THE GARDEN GATE

FIG. 2. THE GATE IN THE HEDGEROW

working shop by anyone with the average amount of experience in this line of work. The two urns represent the only portions which require a machine for their construction. At the same time, this design also will make a splendid problem for the student in a high school where he is provided with ripsaws, jointers, planers, and band saws.

Figure 1 shows that four cedar posts are required, the two center ones being cased with 1-in. cypress to give them the right size above ground. The remainder of the design also is built of cypress and white pine in order to insure good weathering qualities.

With the turned urns on the center posts, wide board with chamfered edges fastened to the battens with carriage bolts, the gate hinges, and the old-fashioned sliding latch, the garden gate fits snugly into the hedgerow and gives the pleasing appearance shown in Figure 2.

## NOW, Are There Any Questions?

### Crude Oil

939. Q.: In your question box you often mention rubbing down a job with crude oil and pumice. Will you explain what you mean by crude oil? Do you mean kerosene or some other oil? Our nearest refinery is running on Panuco (Mexican) and makes good streets or asphalt roofing but hardly seems right for rubbing purposes.—*C. A. A.*

A.: Crude oil, as it comes to us here in the East in drums, is a dark, tarry oil about the same gravity as kerosene. It is about the right body for rubbing, contains enough asphaltum or tars to keep the rubbing sludge dark colored, thereby preventing it showing in corners and other hard-to-clean places. I am of the opinion that your local refinery is working on second-run stock; that is, oil from which the light grades have already been distilled. Perhaps I am wrong, although as I look back over the records of my analyses of crude oils I can find none of the type you mention from the Panuco field.

For your work any light-straw oil, or light floor oil, will be satisfactory. If the bluish bloom natural to petroleum oils is too hard to get rid of after rubbing, then use a trace of oil black aniline to slightly color the oil before rubbing. Clean up with a good polish after the work has been completed.—*Ralph G. Waring.*

### Refinishing a Car

940. Q.: I have a problem in finishing on which I should like your opinion. I am planning on refinishing my car. The present finish shows no checks or other disfigurations, but is badly faded, especially over hood and cowl. I plan a straight lacquer job, using sanding surfacer, 3 coats of lacquer, mist coat, and finishing with a rubbing and polishing compound. This I want to put over the old finish.

The part I am dubious about is our spraying equipment. We have a Binks airway gun that cost us about $20 and a small air compressor. Our compressor tank holds 75 lb. of air, but our supply is not steady as the compressor, being small, cannot maintain for any length of time a pressure which is uniform. Could a person, if willing to wait for the pressure to get up to capacity, (that is, it would mean spray and wait for pressure to come up again), do a satisfactory job? Is our type of gun good enough for auto painting?—*H. B. L.*

A.: I see no reason why you cannot do the car job if you will make a change or two in the spray gun hook-up. In the first place, your reserve tank should be at least as big as a hot-water boiler (35 to 50 gal.). The next thing necessary is a pressure regulator or transformer to handle the pressure uniformly at 45 to 50 lb. When you work at 75 lb., you "bleed" your tank at a rate your small compressor cannot supply. While I have no way of knowing what model gun you have, yet under most conditions a production gun requires about 7 cu. ft. per minute at 60 lb. to afford a slight range. The only really practical gun at low pressures and volume is a new one just put out by the De Vilbiss Co., of Toledo, Ohio, Type CH cup guns. I find this one operates efficiently at 20 to 25 lb. and handles enamels, lacquers, shellacs, etc., with remarkable ease, atomizing them and applying them in a way none of the other makes of guns can even approach.

If you cannot afford to buy a proper transformer (although it would pay for itself on this one job alone), then all you can do is to get up pressure and divide up your job into as many small sections as you can cover with the pressure and volume available.

Be sure and water-sand your entire job with wet-or-dry No. 180 and wash well before spraying. If you do not do this, there is a possible chance that you will have grease spots. Under no circumstances should you use gasoline as a cleaner. Use denatured alcohol, instead, to break up all traces of grease.—*Ralph G. Waring.*

### Painting Bottles

941. Q.: I shall appreciate it very much if you will tell me what kind of paint to use and how to use it to paint bottles, jars, cups, etc., by dipping them in a bucket or container holding water, on the top of which are dropped a few drops of different colored paints. Maybe they call it "marbleize." —*M. C.*

A.: In the process of coloring by dipping as you describe, the colors are floated on water, the article is dipped slowly, and when withdrawn is put away until dry. It may then be varnished or not as you desire.

In detail, the process is as follows:

1. Colors are all "four-hour" enamels.
2. Use a water bath as large as necessary and of such a depth that any article coated can be easily immersed.
3. Allow single drops of well-stirred enamel to drop upon the quiet surface of the water and spread.
4. The pattern may be varied at will by using a straight-edged stick, in which long wires have been fastened at regular intervals, to draw through the colors either in a straight or wavy line.
5. Dip the article either vertically or horizontally as may seem best. Set aside to dry.
6. Under most circumstances the work will need to be repeated for each immersion.—*Ralph G. Waring.*

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### Teachers' Examinations

An examination for teachers of manual training and home economics in the elementary schools of Jersey City, N. J., will be held on Saturday, April 18, 1931. Salary schedules are $2,000 to $3,600 and $1,600 to $3,600 respectively. Information regarding eligibility may be had from E. B. Kent, director of manual training, board of education, Jersey City.

## Among the Industrial-Arts Teachers

¶ Mr. Maurice Dossey has been appointed instructor in woodworking in the junior high school at Alpine, Tex. Mr. Horace Oliver is director of industrial-arts work in the senior high school.

¶ Mr. Roy Chapelle has become instructor in shop activities in the high school at Pearsall, Tex.

¶ Mr. Wallace Patrick, Mr. Thurmond Pettie, and Mr. George Shalkhauser have been appointed as instructors in industrial arts in the high school at El Paso, Tex.

¶ Miss Katherine C. Ball has become director of the placement work in the Technical High School at Dallas, Tex.

¶ Mr. N. S. Hunsdon, state director of vocational education in Texas, has received the bachelor of science degree from the Colorado A. and M. College.

¶ Mr. H. H. Spahr has been appointed instructor in auto mechanics at Port Arthur, Tex.

¶ Mr. Vincent Stupecky has been reëlected as a member of the vocational-school board at Manitowoc, Wis. The other members of the board are Mr. O. H. Senglaub, Mr. R. H. Thoke, and Mr. H. S. Bonar.

¶ The vocational-school board at Fort Atkinson, Wis., has reorganized, with the election of Mr. F. C. Bray, as chairman.

¶ Mr. F. S. Lamar has been elected principal of the Manual Training High School at Kansas City, Mo., to succeed the late Mr. A. A. Dodd.

¶ Mr. Gustave Moeller, 49, head of the art department at the Milwaukee State Teachers' College, died on February 11, at a local hospital, following an operation for appendicitis. Mr. Moeller who was a painter from boyhood, studied at the Wisconsin School of Art, the Chicago Art Institute, the National Academy of New York, and the Royal Academy of Germany. He was in the commercial-art field in New York, but returned to Milwaukee to teach. He was one of the founders of the Art Students' League and a member of the board of trustees of the Art Institute. Mr. Moeller won many prizes for his work and many of his paintings are in Milwaukee collections.

¶ Mr. Ernest W. Schulz, president of the Wisconsin Board of Vocational Education, was recently presented with a life membership in the American Vocational Association.

¶ Mr. Michael J. Teske and Mr. Charles O. Boswell have been appointed to the vocational school board at Duluth, Minn.

¶ Mr. Carlton Saecker has been reëlected as president of the vocational school board at Appleton, Wis.

¶ Mr. Donald Potter, manual-training instructor at Dunlap, Iowa, died at a hospital in Carroll of heart disease, following an operation for appendicitis.

¶ Mr. William N. Doak has been elected chairman of the Federal Board for Vocational Education, to succeed Mr. James J. Davis.

¶ Prof. George A. Willoughby, head of the industrial-arts department of the Michigan State Normal College, Ypsilanti, Mich., has been made a member of the national honorary fraternity of practical arts and vocational education, Epsilon Pi Tau.

## Association and Convention News

### THE BOSTON VOCATIONAL SOCIETY

The annual get-together meeting of the Vocational Education Society of Boston was held on Saturday evening, January 10, at the Hotel Westminster, Boston.

The speaker of the evening was Prof. John J. Mahoney, of Boston University, who took for his subject, "Vocational Education and a Better World for Work." The speaker opened his talk with the statement that he realized that it was a dangerous time to criticize our economic order. He admitted that the American standard of living is superior to any on the earth and that the people have received their share of the world's prosperity despite the recurrent seven-year cycle of industrial depression. The present condition, he said, points out plainly that something is wrong, and the common explanation of the cause is overproduction. Professor Mahoney said he did not believe that overproduction is the cause of the present situation, but that it is due to underconsumption. To relieve the situation, he urged the development of a more adequate economic understanding. It ought to be the policy of the merchant, he said, to cultivate potential buyers, and to establish good will. That we must do this for our own economic prosperity should be an essential American understanding.

Professor Mahoney pleaded for a better understanding between capital and labor. He urged a larger measure of industrial democracy, and held that the country will never improve except through education that will develop a better economic understanding. Education properly conceived, he said, should make for harmony between capital and labor, a better political and social order, as well as less racial animosity.

Professor Mahoney stressed the need for persons in vocational education who will recognize the demand for the development of skill in the occupations as the aim of all their work. He urged the development of a sound economic understanding as an item of major importance in the direction of a better work for the world in general.

At the close of the address, a short business meeting was held, at which 10 new members were elected to membership in the society. Souvenirs and prizes were distributed among the 146 members in attendance.

The February meeting of the Vocational Education Society of Boston was held on Saturday, February 14, at the Hotel Westminster, Boston.

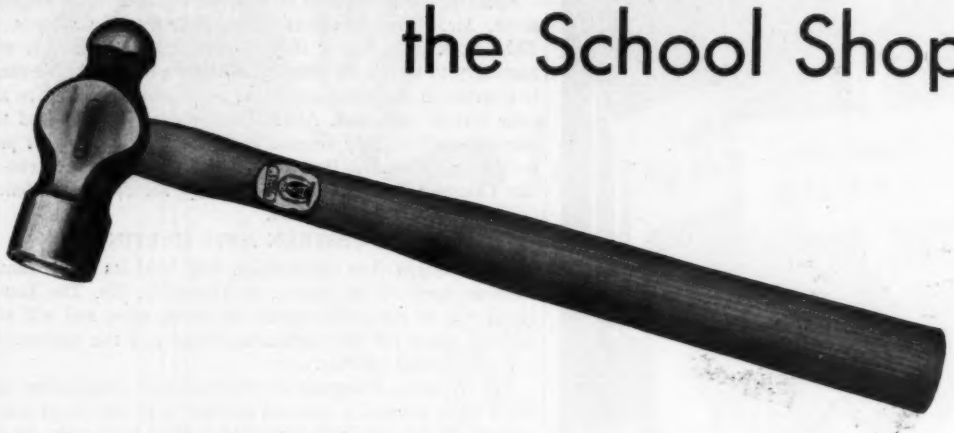
Following the luncheon, a business meeting was held, at which Mr. Thomas Flinn and Mr. Edward White were elected to membership. Mr. Fletcher Barbour was made an honorary member of the society.

The meeting opened with a talk by Mr. J. W. Stepp, Boston manager of the S. D. Warren Company, who discussed papermaking and the changes in the manufacturing processes which have taken place as a result of modern machinery and manufacturing methods. In giving an idea of the size of the Warren plant, he said it takes forty acres of timber to run the paper mill for one day. Seven carloads of raw material are required for each carload of finished paper. An electric plant is used by the company, which is large enough to supply the city of Portland, Maine, with electricity.

Mr. Stepp pointed out that paper from wood pulp is manufactured by one of two processes, either the mechanical method by which the wood is ground to pulp, or by the chemical method in which the wood is cut into chips and the chips cooked. The mechanical method uses about 95 per cent of the

(Continued on Page 24a)

# For The Exacting Requirements of the School Shop



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No. 647—8/32" No. 648—10/32"

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(Continued from Page 156)

log, including all of the impurities. Paper made entirely from spruce is too hard for commercial uses, so poplar is mixed with the spruce to give it a softer surface for printing.

Speaking of the method of selecting candidates for employment, Mr. Stepp said that they could get any amount of $20-a-week men, but if they wanted a $5,000 man, it was necessary to search the country. Usually a blind advertisement is inserted in the newspapers and applicants are asked to answer certain questions. After the applicants have passed the plant executives, they are sent to the mill for a two-year probationary course. At the end of that time they are sent to the Carnegie Institute of Technology for special technical training.—*Louis A. Van Ham.*

## THE WESTERN ARTS MEETING

The Western Arts Association will hold its 1931 annual meeting April 28 to May 1, at Louisville, Ky. The Brown Hotel will be the headquarters for the meeting and will also provide space for the various meetings and the commercial and educational exhibits.

The Western Passenger Association and coöperating railroads have granted a one and one-half fare rate from points beyond the 67-cent limit, provided tickets are bought on the certificate plan.

The school-equipment firms will have displays of their products on the lobby floor of the headquarters hotel, while the remainder will be placed on the mezzanine floor where many of the meetings will be held. A few choice wall spaces have been reserved for special school exhibits.

The program committee has prepared an interesting program for the meeting. At the Tuesday session, Mr. T. T. Lindsay, of Peabody College for Teachers, Nashville, will talk on "Upgrading the Manual Arts"; Mr. T. R. Abercrombie, of Cincinnati, Ohio, will discuss "The Washington Junior High School"; Miss Minnie S. Martin, of the West Kentucky Normal School, Bowling Green, will take up "The Needs of the Grade Teacher in Art"; and Mr. W. F. Webster, of Minneapolis, will give a brief talk. Mr. J. H. McCloskey, Lakewood, Ohio, will discuss "Drawing" and Mr. John J. Metz, Milwaukee, Wis., will present the summary.

On Wednesday, Mr. Harry L. Gage, of New York City, will talk on "Art and the Business Man."

At the Thursday session, Mr. Alfred G. Pelikan, Milwaukee, Wis., will talk on "Art Principles Applied to Manual-Arts Projects"; Mr. Harry L. Gage will take up "The Fine Arts and the Printer"; Mr. Thomas E. Dunwoody, of the Pressmen's Home Trade School, Tennessee, will discuss "The 1930 Book of Art Printing"; Miss E. M. Lovell, of Louisville, Ky., will talk on "The Printing School and Art Education"; and Mr. K. S. Bolander, of Columbus, Ohio, will take for his subject, "The Twentieth Century Taste in Home and Office Decorating."

On Friday, Dr. W. T. Bawden, of Peoria, Ill., will present a summary of the discussions. Mr. Alon Bement, of New York City, will talk on "America Comes Into Her Own in Design" and on "Figure Construction."

At the close of the general session, there will be a business meeting with award of prizes.

## THE EASTERN ARTS MEETING

The Annual meeting of the Eastern Arts Association will be held April 8–11, at Atlantic City, N. J. President Forest Grant, of New York City, will preside.

At the opening session on Wednesday morning, there will be an address of welcome, appointment of committees, and an address by Mr. C. Howard Walker, of the American Institute of Architects.

In addition, there will be a talk by Dr. William A. McAndrew, of New York City, on "Art for the Land's Sake"; Prof. Hughes Mearns, of New York University, will discuss "Creative Power"; Prof. S. Chatwood Burton will take for his sub-

(Continued on Page 29a)

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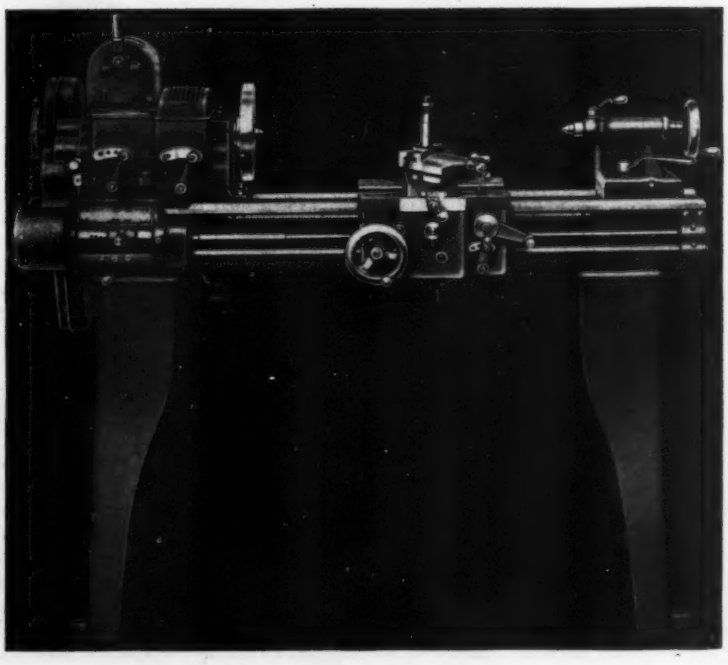
**The R. K. LEBLOND Machine Tool Co.**
CINCINNATI, OHIO, U. S. A.



SEE OUR DATA IN BRUCE'S SCHOOL SHOP ANNUAL 1931 EDITION

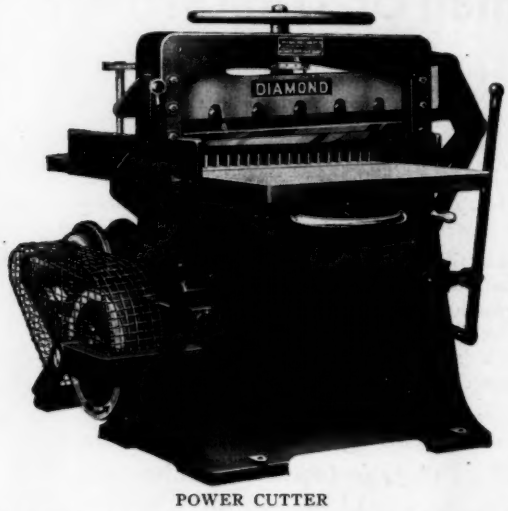
*Write for complete details of the LeBlond Regal Line.*

# SCHOOL SHOP EQUIPMENT NEWS

For the Supervisor or Teacher who desires to keep abreast with news of new Machinery, Tools, Supplies, etc.

### NEW CHALLENGE DIAMOND POWER CUTTER

The Challenge Machinery Company, of Grand Haven, Mich., has announced the marketing of its Diamond power cutter, with Frazee-Saur safety device, which has been designed as an ideal safeguard for printing students. This new cutter absolutely prevents accidents to student operators



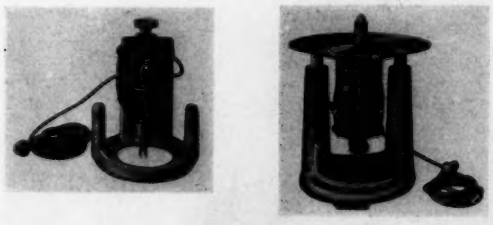

POWER CUTTER

and insures the ultimate in long life and low-cost performance. The operating device comprises two levers, which require the use of both hands. When the operator releases either hand, the machine instantly stops, so that there is no chance for injuries. Adequate additional safety features are also provided.

Complete descriptive information and prices may be obtained upon request.

### NEW HUMPHREYS NO. 90 ROUTING MACHINE

The Hugh Humphreys Machinery Company, 2812 May Street, Cincinnati, Ohio, manufacturers of woodworking machinery, has produced a new No. 90 routing machine. This machine can handle a large variety of work. It has a speed of 7,200 r.p.m. for heavy cuts and 10,000 r.p.m. for light cuts. It is so made that the operator can see the work being done continually. A sentinel breaker switch automatically protects the motor against overload. The machine is equipped with a micrometer feed adjustment, and it cuts so smoothly that no further sanding is necessary.



ROUTER AND SHAPER

Set in a special column with a ground steel table attached, and supplied with an insert spindle with cutters and collars, transforms this routing machine into a combination routing and shaping machine. In this way it can be relied upon to do as creditable work as a vertical shaper as it does when used as a routing machine.

In order to take care of deep cuts the machine has been equipped with a motor that will develop ¾ h.p. at full speed.

### CARE AND OPERATION OF CIRCULAR-SAW BENCHES

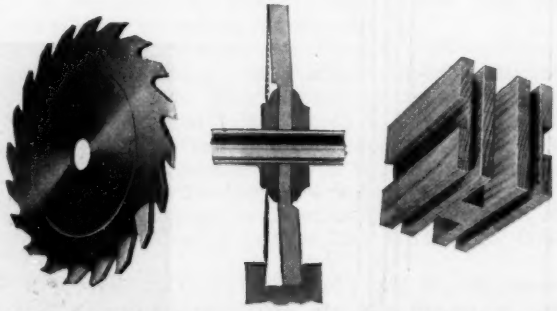
The Oliver Machinery Company, Grand Rapids, Mich., manufacturers of woodworking machinery, has issued a booklet on *The Installation, Care, and Operation of Oliver Circular-Saw Benches,* which will be found very useful by school officials who have in charge the supervision of installing and operating such equipment.

The booklet is divided into five parts, comprising information on installation, nomenclature, saw blades, safety rules, and operations. It discusses such common operations as ripping, rabbeting, grooving, simple crosscutting, squaring, crosscutting wide stock, dadoing and gaining, tenoning, producing square-shouldered tenons, simple mitering, cutting compound miters, grooving for splined miter joint, cutting wedges, tapering square legs, and the use of special jigs and fixtures.

This valuable booklet may be obtained upon request from the Oliver Machinery Company.

### NEW HUTHER SAW

The Huther Bros. Saw Manufacturing Company, Rochester, N. Y., has placed on the market a new grooving saw for use on any saw mandrel. The saw is useful for cutting with or across the grain. Its free-cutting qualities and the fact that it runs without setting, makes it an ideal saw for grooving work.



Complete information and prices may be obtained by any school-shop instructor upon request.

### CATALOG OF ARC-WELDING SUPPLIES

The Lincoln Electric Company, of Cleveland, Ohio, manufacturers of arc-welding equipment, has just issued a 20-page circular, illustrating and describing the arc-welding supplies, including carbon electrodes, shields, holders, cables, clothing autogenizers, and other accessories of the welding field.

The pamphlet contains a brief description of the Fleetweld process, a new welding process developed by the firm, which has produced excellent results and which combines both tensile strength and high ductility at low cost. It resists corrosion to the same degree as the plate, or more so, due to the absence of oxides and nitrides in the weld material.

The last part of the pamphlet contains a list and description of repair parts, as well as a list of books and papers on welding.

ADVERTISING PAGES REMOVED



(Continued from Page 24a)

ject, "Stage Craft Under Limitations"; Dr. Arthur Dean will deliver a memorial address to Mr. F. E. Mathewson, late secretary of the association; Supt. A. J. Stoddard, of Providence, R. I., will also give a talk at one of the morning sessions.

### THE PEORIA INDUSTRIAL-EDUCATION CLUB MEETING

The Peoria Industrial-Education Club held their regular monthly meeting at the Cozy Tea Room, Peoria, on Saturday, January 10.

Following the dinner, Mr. Harvey L. Hurff, of Bradley Institute, spoke on "The Selection, Care, and Use of Saws." Mr. F. E. Dace, of the same institution, talked on "Einstein's Theory of Light."

The new semester's program provided for meetings on March 9, April 6, and May 11. Talks will be given on Aviation, The Milwaukee Convention, The Manual-Arts Conference, and The Louisville Convention of the Western Arts Association. There will be a joint meeting of the industrial-arts and home-economics teachers, when speakers of prominence in both fields will address the two groups. — *F. E. Hardin.*

The monthly dinner meeting of the Peoria Industrial-Education Club was held on Monday evening, February 9, in the Peoria Y.M.C.A. Representatives were present from the Peoria high and graded schools, as well as the Bradley Polytechnic Institute, the Caterpillar Tractor Training School, and the Manual Arts Press. Twenty-eight club members were present.

Prof. C. M. Hewitt, of Bradley Institute, opened the meeting with an interesting talk on "Sidelights of Aviation." He pointed out that the application of the Diesel engine to aviation would reduce the weight per horse power, but would practically eliminate the fire hazard in flying. Professor Hewitt called attention to the fact that there had been only one fatal accident on the regular transport schedules during the first part of 1930. Mr. L. L. Simpson, business manager of the Manual Arts Press, described the commercial exhibits at the Milwaukee convention of the American Vocational Association last December.

The next meeting of the club will be held March 9, with a dinner at the Y.M.C.A. Building. The speakers will be Mr. B. S. Moffatt, Mr. C. A. Bennett, and Mr. A. F. Siepert. — *F. F. Barloga.*

### THE TULSA MANUAL-ARTS CLUB MEETING

The January meeting of the Tulsa Manual-Arts Club of Tulsa, Oklahoma, took up the discussion of related work in mechanical drawing, the functioning of mechanical drawing in shops, and other topics. Mr. S. S. Orman spoke on the first topic, and Mr. J. W. Bollinger on the second.

At the February meeting of the club, Mr. J. M. Maurer, director of industrial research of the chamber of commerce, was the guest speaker. He gave a fine presentation of the present business depression and its effect on conditions in Tulsa, pointing out that the city can no longer depend on the income from the manufacture of oil products, but must diversify its manufactures so as to include other lines. The talk did much to dispell some of the haziness about the subject and brought the attention of the members to the vital questions affecting the business life of the city.—*J. W. Bollinger.*

### MISSOURI TRADE AND INDUSTRIAL TEACHERS' CONFERENCE

The fourth annual conference of the Trade and Industrial-Education Teachers of Missouri will be held April 24 and 25, at the University of Missouri. Among the speakers at the con-

(Continued on Page 32a)


# $3,200.00 *for a* Hammer!

**THAT'S what one cheap hammer cost, when the head chipped and destroyed the sight of a machinist's eye.**

**"7,389 persons were injured by hand tools in New York State in one year."— from New York State Department of Labor Bulletin on "Hand Tool Accidents." Many injuries were caused by cheap tools; some by improper use. *Hammers* caused more accidents than any other tool.**

**You can help to eliminate this condition... by teaching the *economy* and *safety* of quality tools, and by giving instructions in proper methods of use.**

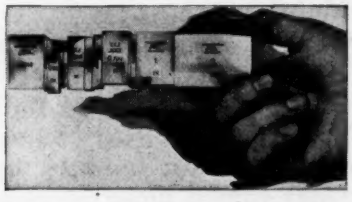
**Specify Plumb Hammers for the school shop. They have seventy years of steel treating and tool making experience behind them; and exclusive safety features which safeguard even the inexpert boy.**

FAYETTE R. PLUMB, INC.
Philadelphia, U. S. A.

# Johansson

## Gage Blocks and Accessories

*establish a manufacturing standard measurement of length that is recognized the world over*



JOHANSSON GAGE BLOCKS are rectangular pieces of tool steel that are hardened, ground, stabilized and finished to a predetermined size — within an accuracy of two, four or eight millionth parts of an inch. THEY EMBODY IN THEIR COMMERCIAL MANUFACTURE, THE SOLVING OF FOUR METALLURGICAL AND MECHANICAL PROBLEMS IN STEEL:

1 — FLAT SURFACES, 2 — PARALLEL SURFACES, 3 — ACCURACY AS TO DIMENSIONS, 4 — EFFECTIVE SEASONING.

The rectangular shape is the form preferred by experienced mechanics, as attested by the demand for and use of more than 13,000 different sets and thousands of individual gage blocks.

The Johansson Gage Blocks have two flat, parallel surfaces, a predetermined distance apart, with an extremely high finish. When cleaned and slid one on the other, with a slight inward pressure, they take hold due to molecular attraction, capillary power and atmospheric pressure. The combination of gage blocks have the properties of a solid block.

These gage blocks in sets or combinations make consecutive size gages from specified minimum to maximum dimensions of length, in sizes varying according to requirements and limits to which you work. There is a gaging system to meet every requirement. Made in three accuracies.

Delivery from stock.

Prices and literature on application — order direct or through your mill supply dealer

C. E. JOHANSSON, *Inc., Division of*

## FORD MOTOR COMPANY

Detroit, Michigan


(Continued from Page 29a)

ference are: Dr. J. C. Wright, of Washington, D. C.; Mrs. Anna L. Burdick, of Washington; Mr. Laurence Parker, of Pittsburg, Kans.; and Mr. R. V. Billington, of Washington, D. C.

The meeting will be conducted on the conference basis and will be informal in nature, but definite and accurate material will be provided by designated leaders.

# NEWS NOTES

**Aviation Courses at Wausau, Wisconsin**

Two advanced courses in aviation are being offered at Wausau, Wis., under the direction of the University Extension Division, and with the coöperation of the vocational school. The courses cover elementary aëronautics and airplane engines and are supplemented with lectures and test material bearing on the subjects. The purpose of the courses is to present the fundamentals of aircraft engine operation, construction, and design.

**New Courses at Orlando Vocational School**

Courses in blue-print reading and estimating, the use of the steel square, and roof framing are being offered in the vocational school at Orlando, Fla.

**Increased Enrollment in Vocational Classes**

The vocational classes at the Main Avenue Senior Night School, San Antonio, Tex., opened for the second semester, with an increase of 223 students. The total enrollment was 1,119 students. Cafeteria management, a new course, attracted 55 students. The aviation course enrolled 10 new students.

**School Receives $60,000 Bequest**

The Glenwood Manual Training School, at Glenwood, Ill., recently received a $60,000 bequest under the terms of the will of Cary C. Barr, a Streator manufacturer.

**Vocational School at Fort Atkinson, Wisconsin**

Plans have been completed for the establishment of a day vocational school at Fort Atkinson, Wis. Boys who do not attend public schools, but who are between the ages of 14 and 18, will be required to attend the school as required by the state law.

**New Metal-Work Course at Minneapolis, Minnesota**

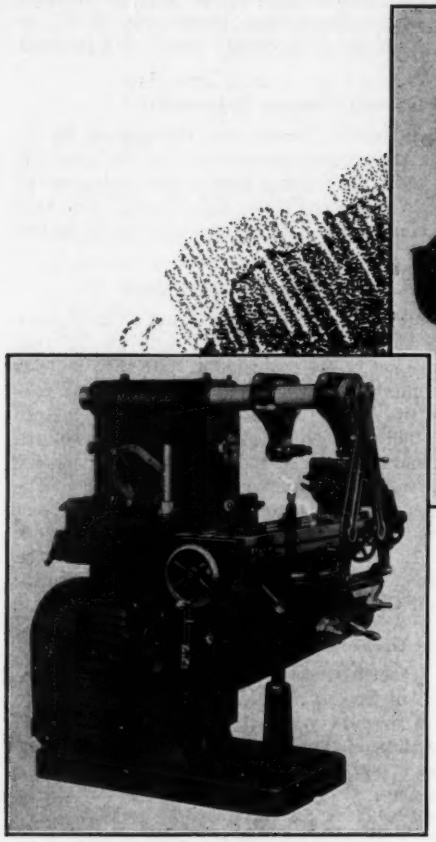
A general metal-work course has been established in the Boys' Vocational High School, Minneapolis, Minn., with an enrollment of 60 boys. The preliminary course is for one year, and boys of 15 years or older are eligible. Specialized trade training will be provided to follow the course at the Boys' Vocational High and Dunwoody Institute.

**West Virginia Asks for More Vocational Funds**

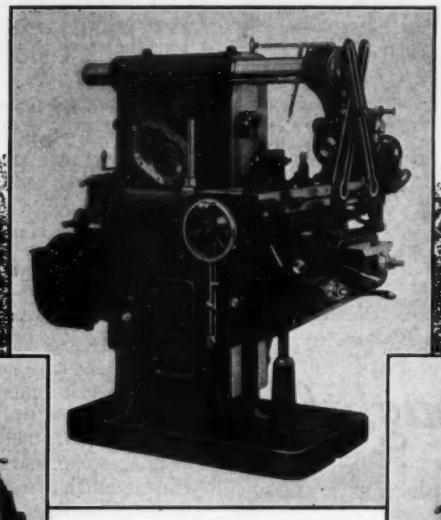
A resolution has been presented to the West Virginia Legislature asking that body to equal the allotment of the Federal Government to the state vocational association. The state budget commission recommended an appropriation of $30,000, while the federal grant is $116,761. In order to obtain the federal appropriation, it must be matched by the state, or by contributions by local groups. The money is to be used for vocational-training courses in the secondary schools and colleges of the state.

(Continued on Page 32a)

# Your "Boy Product" . . . . . is Most Important!

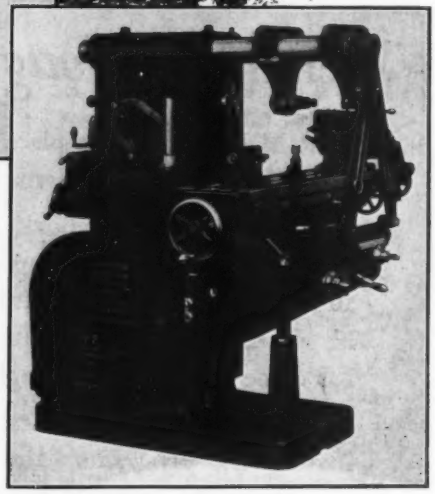


*No. 1 Special Universal*
*Belt Drive* .....$2375.00
*Motor-in-Base Drive*..... 2325.00
*Catalog 28-A*



*No. 1 Universal*
*Belt Drive* .....$2155.00
*External Motor Drive*.. 2255.00
*Catalog 27-A*

*Milwaukee Milling Machines are of modern design with the universal features necessary for student instruction. The three machines illustrated have been selected as especially suitable for school shop use.*



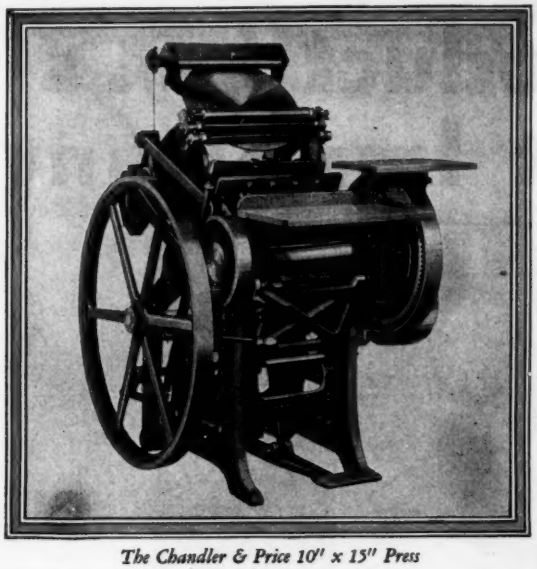
*No. 2 Special Universal*
*Belt Drive* .....$2440.00
*Motor-in-Base Drive*..... 2390.00
*Catalog 28-A*

If you were training boys as automobile mechanics you wouldn't think of using a 1910 model for instruction purposes. You'd have the most widely used modern motor car. . . . Should not the same logic be followed in training the boy machinist who will soon take his place in the industrial life of your community?

When metal-working plants, the industrial buyers of machine tools, want quality and quantity production of milled parts, many of them turn to Milwaukee Milling Machines. All industries, big or little, whether in production or general work, use Milwaukees. . . . This fact suggests that Milwaukees should have a definite place in every school shop training program.

Place a Milwaukee Milling Machine in your school machine shop. Your investment will insure the success of your "boy product".

**KEARNEY & TRECKER**
**MILWAUKEE**
**MILLING MACHINES**
MILWAUKEE, WISCONSIN



*The Chandler & Price 10" x 15" Press*

# Weigh this *thoughtfully*

PRINTING takes its place as a most vital activity in the modern curriculum.

Printing trains the boy's mind and fingers. It enhances his appreciation of all that is fine and artistic. It helps open his mind to the labored wealth of art that has come down to us through the ages.

Printing is equally practical. Notices, invitations, programs, diplomas, announcements—you know how many forms, as well as school papers, can be turned out in your own buildings. And such an atmosphere all the while accustoms the man of later years to use printed matter conveniently, economi cally, successfully.

Have you *enough* Gordons in your Printing Department? Are you perhaps ready to start such a department? In either event, Chandler & Price will be glad to counsel with you.

Chandler & Price
PAPER CUTTERS & PRESSES

THE CHANDLER & PRICE COMPANY
*Cleveland, Ohio, U. S. A.*

(Continued from Page 30a)

**Civil Service Examination for Teachers**

The U. S. Civil Service Commission has announced a competitive examination, to be held on March 25, for the positions of boys' adviser in the senior high school, boys' adviser in reservation and junior high school, and adviser's assistant. The examination is to fill vacancies in the Indian service, and applicants must meet rigid requirements for training, experience, and writings. Complete information may be obtained from the Civil Service Commission, Washington, D. C., or from the secretary of the Civil Service Board of Examiners at any post office.

**Examination for Industrial-Training Department**

The U. S. Civil Service Commission, Washington, D. C., has announced a competitive examination for the positions of head of the industrial-training department, instructor of shop subjects in the junior and senior high schools, to be held March 25. The examination is to fill vacancies in the Indian service.

**Instructors of Smith-Hughes Vocational Agriculture**

The Kansas State Agricultural College invites all instructors of Smith-Hughes vocational agriculture to enter two of their students who have not before competed in state shop contests for the annual contest in shopwork and agricultural engineering. The contest will be held on Monday and Tuesday, April 27 and 28, 1931. Individual prizes will be presented to winners of first, second, and third places, and the school receiving the highest ranking will be recognized in a suitable way. The names of the boys who are to enter the contest should be sent to the Shop Practice Department of the college on or before Saturday, April 25. For further information address Eugene C. Graham, Associate Professor of Shop Practice, Kansas State Agricultural College, Manhattan, Kansas.

**Vocational School Opened at Newnan, Georgia**

A vocational school has been opened at Newnan, Ga., under the direction of Supt. C. E. Mathews. The courses are open to all boys over 14 years of age, who are employed and who need additional training for their work. The school is conducted on a part-time basis, with students attending whenever convenient.

**Bureau of Mines Motion-Picture Films**

The U. S. Bureau of Mines, at Pittsburgh, Pa., which has the world's largest collection of industrial educational motion pictures, added more than 400 reels of films during the year 1930. The films show the workings of the nation's great mineral industries and unfold the stories of petroleum, silver, iron, copper, lead, sulphur, asbestos and many other mineral materials on which the country depends. At the beginning of 1931, the Bureau had more than 700 sets of films, representing an investment of $1,000,000. The films, which cover nearly 60 different subjects, pertain to the mineral and allied industries, and are being widely used by educational institutions in connection with mining, engineering, and chemical courses. The films are lent by the bureau for exhibition purposes upon the payment of the transportation costs.

**New Agricultural Building**

The school board at Oconomowoc, Wis., recently erected an agricultural building for the high school, in order to relieve overcrowded conditions. The building contains space for a workshop, a classroom, and complete equipment.

**Aircraft Contest at San Antonio, Texas**

In a model aircraft contest held at Lions Field, San Antonio, Tex., Ralph Dorchester and Len Proffit were the winners. These boys built and operated model scale planes which were capable of flying considerable distances.